DOCUMENT RESUME

ED 458 252 TM 033 414

TITLE	Alabama Science Course of Study: Assessment Correlation.
INSTITUTION	Alabama State Dept. of Education, Montgomery.
PUB DATE	1999-00-00
NOTE	813p.; For other Alabama courses of study, see TM 033 412-415.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF05/PC33 Plus Postage.
DESCRIPTORS	*Academic Standards; Achievement Tests; Correlation; *Course Content; *Curriculum; Elementary Secondary Education; *Sciences; State Programs; State Standards; Testing Programs
IDENTIFIERS	Alabama; *Alabama High School Graduation Examination; *Stanford Achievement Tests

ABSTRACT

This document is designed to show the connection between the required state-written curriculum (courses of study) and the state-tested curriculum (the Alabama High School Graduation Examination and the Stanford Achievement Test, Ninth Edition [Stanford 9]) in Science. The document illustrates that courses of study content standards embody both Alabama High School Graduation Examination and Stanford 9 objectives, demonstrating that local education agencies may feel confident developing local curriculum based on one document: the state course of study. Each page of this document contains four columns. The first is the course of study content standards, and the second places the Alabama High School Graduation Exam objectives, with eligible content, beside the related content standard. The third column contains an "X" for the Stanford 9 correlation to the course of study, indicating that one or more components of the content standard is tested on the Stanford 9. The fourth column is designed for local use; a system may choose to list instructional strategies or resources here. The standards are given for kindergarten through grade 8, and for Physical Science, Biology Core, Chemistry Core, and Physics Core. (SLD)

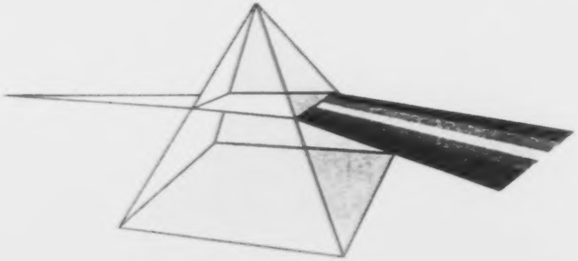
Reproductions supplied by EDRS are the best that can be made
from the original document.

TM

ED 458 252

ALABAMA

Science Course of Study - Assessment Correlation



Classroom Improvement
Division of Instructional Services
State Department of Education
Ed Richardson, State Superintendent of Education

Summer 1999

BEST COPY AVAILABLE

U.S. DEPARTMENT OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
T.E. Ingram, Jr.
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

TM033414

SCIENCE COURSE OF STUDY — ASSESSMENT CORRELATION

TABLE OF CONTENTS

Acknowledgments iii
Introduction iv
Directions for Interpreting the Correlation Document v
Kindergarten 1
1st Grade 16
2nd Grade 38
3rd Grade 54
4th Grade 76
5th Grade 107
6th Grade 132
7th Grade 168
8th Grade 217
Physical Science 257
Biology Core 297
Chemistry Core 337
Physics Core 372

ACKNOWLEDGMENTS

Process Managers

Frank Heatherly, Ed.D.
Paul Wylie, Ed.D.

Program Managers

Kay Atchison-Warfield, Ed.D., Elementary Science Specialist
Robert Davis, Secondary Science Specialist

Assisting Classroom Improvement Personnel

Susan Blankenship, Executive Secretary to State Courses of Study Committees
Anne P. Graham, Information Specialist

Sharon Bolton, Support Staff
Leigh Ann Kyser, Support Staff
Freda Thrower, Support Staff

Cynthia C. Brown, Coordinator, Classroom Improvement Programs Unit
Anne M. Jones, Administrator, Classroom Improvement Section
Joseph B. Morton, Ph.D., Deputy State Superintendent of Education

INTRODUCTION

Science Course of Study — Assessment Correlation

An important factor in improving students' achievement is the alignment of written, taught, and tested curricula. The basis of both the taught and tested curricula is the written curriculum—the course of study. This document is designed to show the connection between the required state-written curriculum (courses of study) and the state-tested curriculum (the *Alabama High School Graduation Exam* and the *Stanford Achievement Test,* Ninth Edition, Stanford 9). Courses of study contain content standards that are the blueprints to be used by systems as they align their curricula locally. The content standards in the courses of study prescribe, from the state level, exactly what students should know and be able to do at the conclusion of any grade level or course. In the past, aligning these three types of curriculum may have been a cumbersome task because the standards/objectives were contained in different documents and had to be meshed/combined to create a composite of all state requirements.

This document illustrates that courses of study content standards embody both *Alabama High School Graduation Exam* and Stanford 9 objectives. Local Education Agencies may feel confident in developing local curriculum based on one document—the state course of study. In the elementary grades, course of study content standards are rarely worded in such a fashion as to be easily recognized as *Alabama High School Graduation Exam* standards or objectives. Yet, skills and concepts are identified at each grade level, K-6, that are foundational and prerequisite to the development of graduation exam standards and objectives. The teaching of all content standards in the course of study should adequately prepare students for any state or national assessment.

Directions for Interpreting the Science Course of Study — Assessment Correlation Document

Each page of the document contains four columns. The first column is the course of study content standards; the second column places the *Alabama High School Graduation Exam* objectives, with eligible content, beside the related content standard that must be mastered at this grade level or in this subject. The third column contains an "X," instead of objectives, for the Stanford 9 correlation to the course of study because the Stanford 9 material is copyrighted. In the Biology, Physical Science, Chemistry, or Physics part of this document, an "X" indicates that there is a correlation to at least one component of the content standard. The fourth column is designed for local usage; for example, if using the document prior to aligning the curriculum locally, a system may choose to list instructional strategies or resources here.

Alabama High School Graduation Exam Standards

The following science standards are referenced only by number throughout the document.

STANDARD I:
The student will understand concepts dealing with nature of science.

STANDARD II:
The student will understand concepts dealing with matter.

STANDARD III:
The student will understand concepts of the diversity of life.

STANDARD IV:
The student will understand concepts of heredity.

STANDARD V:
The student will understand concepts of cells.

STANDARD VI:
The student will understand concepts of interdependence.

STANDARD VII:
The student will understand concepts of energy.

STANDARD VIII:
The student will understand concepts of force and motion.

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
CONTENT STANDARDS Students will			
1. Demonstrate attitudes necessary for scientific investigation. - Curiosity - Readiness to learn from experiences - Willingness to postpone final judgment	I-1 Analyze the methods of science used to identify and solve problems.	X	
2. Use investigations in science to serve a variety of purposes. - Exploring their world - Verifying previous results - Comparing results	I-1 Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
3. Use science skills. - Observing - Communicating - Classifying - Comparing - Predicting	I-1	Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
4. Practice using critical-thinking skills in daily experiences. Examples: selecting foods in lunchroom, solving problems			X	
5. Recognize shapes and patterns in nature and in things people make. Examples: spirals in shells, shapes of leaves, windows and bricks in a building	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
5. (continued)	• Order the proper sequence of steps within the scientific process.		
6. Apply mathematical skills to scientific investigations. Examples: graphing, ordering, sequencing, measuring	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Order the proper sequence of steps within the scientific process.	X	
7. Explore non-standard units of measurement.		X	
The Dynamic Earth			
8. Describe the major features of the Earth's surface. Examples: rivers, deserts, plains, valleys, oceans, mountains			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Matter			
9. Observe states of matter. - Solid - Liquid - Gas	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		
10. Observe physical changes of matter. - Melting - Freezing - Bending - Tearing	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
10. (continued)	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
Energy			
11. Investigate the connection between vibration and sound. Examples: voices, drums, bells, strings	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.		
	VII-2 Relate waves to the transfer of energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Force and Motion			
12. Investigate the motion of various objects. Examples: pulled toy, spinning top, toy car rolling down incline	VII-1 Relate the Law of Conservation of Energy to energy transformations.		
	VII-2 Relate waves to the transfer of energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
13. Describe the motion of objects in their world. Examples: cars, wind-blown objects, swings	VII-2 Relate waves to the transfer of energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.	X	
	VIII-1 Relate Newton's three laws of motion to real-world applications.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
Diversity				
14. Describe a variety of things found in the environment. Examples: plants, animals, rocks, soil	III-2	Differentiate structures, functions, and characteristics of plants.	X	
	III-3	Differentiate structures, functions, and characteristics of animals.		
	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments.		
15. Compare size, shape, and structure of living things. Examples: flowers to trees, birds to mammals	III-2	Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
15. (continued)	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring.		
Heredity 16. Observe similarities and differences in offspring of plants and animals.	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring.	X	
17. Observe changes that are part of simple life cycles. - Plants: seed, flower, fruit - Animals: egg, young, adult	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
17. (continued)	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
Interdependence 18. Explore ways in which organisms and objects react to changing conditions. Examples: people wear sweaters in the fall, animals' coats change, ponds freeze in the winter, balls move on inclines	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Interdependence			
18. (continued)	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
	III-3 Differentiate structures, functions, and characteristics of animals. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resources and predict outcomes of that competition.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Interdependence 18. (continued)	• Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		
	VII-2 Relate waves to the transfer of energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
	VIII-1 Relate Newton's three laws of motion to real-world applications.		
	VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
19. Recognize that plants and animals depend upon each other. Examples: cows eat grass, squirrels live in trees, gardens need weeding and watering	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes.	X	
	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
20. Explore the survival needs of plants and animals. - Water - Food - Air - Shelter - Space/Area	II-1	Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes.	X	
	III-2	Differentiate structures, functions, and characteristics of plants.		
	III-3	Differentiate structures, functions, and characteristics of animals.		
	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify species that are competing for resources and predict outcomes of that competition.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
21. Explore how loss of habitat can endanger plants and animals. Examples: clearing of forests, loss of wetlands	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		
22. Recognize technology in the school, home, and community. Examples: computer, pencil, refrigerator, Velcro, fire truck			X	
23. Recognize how technology is applied to daily life. Examples: medicines, recycled products, computer games, telephone	VII-1	Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.	X	
	VIII-1	Relate Newton's three laws of motion to real-world applications.		
	VIII-2	Relate force to pressure in fluids. • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum and turgor pressure.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
24. Serve the school through a science-related project. Examples: planting a tree, picking up litter, recycling classroom paper			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
CONTENT STANDARDS			
Students will			
1. Demonstrate attitudes necessary for scientific investigation. - Curiosity - Readiness to learn from experiences - Willingness to postpone final judgment	I-1 Analyze the methods of science used to identify and solve problems.	X	
2. Use investigations in science to serve different purposes. - Exploring their world - Verifying previous results - Comparing results	I-1 Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	
3. Use science skills. - Observing - Communicating - Classifying - Comparing - Predicting	I-1 Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
3. (continued)	• Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
4. Use critical-thinking skills in daily experiences. Examples: making choices, solving problems		X	
5. Recognize shapes and patterns in nature and in things people make. Examples: spirals in shells, shapes of leaves, windows and bricks in a building	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Order the proper sequence of steps within the scientific process.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
6. Apply mathematical skills to scientific investigations. Examples: graphing, ordering, sequencing, measuring	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Order the proper sequence of steps within the scientific process.	X	
7. Explore standard and non-standard units of measurement.			
The Earth in Space			
8. Describe what can be observed in the sky by the unaided eye in the day and at night. - Sun - Moon - Stars			
9. Identify the basic components of the solar system. - Sun - Planets - Moons			

1ST

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
The Dynamic Earth			
10. Observe the effects of weather. - Erosion - Natural disasters Examples: floods, droughts, tornadoes, hurricanes	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		
	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
	VIII-1 Relate Newton's three laws of motion to real-world applications.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Matter			
11. Observe that objects in the world vary greatly in their properties. Examples: size, shape, color, texture, taste, odor	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases.		
12. Describe findings from investigating solids and liquids.	I-1 Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
12. (continued)	• Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.		
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		
	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
13. Investigate the physical changes of matter. Example: popping popcorn	I-1	Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
	II-1	Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.		
	II-2	Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
13. (continued)	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
Energy			
14. Investigate sources of energy. - Moving water - Food	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
14. (continued)	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
	VII-2 Relate waves to the transfer of energy.		
15. Associate sound with vibrating objects. Examples: human voice, musical instruments, rubber band	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy-mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
15. (continued)	VII-2 Relate waves to the transfer of energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
Force and Motion			
16. Explore how movement of objects influences other objects.	VIII-1 Relate Newton's three laws of motion to real-world applications.		
Examples: magnetic attraction, collision of marbles	VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
17. Describe the motions of common objects in terms of speed and direction. Examples: rolling or thrown balls, wheeled vehicles, sliding objects	VIII-1	Relate Newton's three laws of motion to real-world applications.	X	
18. Demonstrate and describe motion as a change of position. Examples: classmates observed walking across the room, distance measured between objects after they are moved	VIII-1	Relate Newton's three laws of motion to real-world applications.	X	
Diversity				
19. Describe how plants and animals survive in the environment. Examples: insects pollinating flowers, trees hosting parasites, birds eating fruit and spreading seed	II-1	Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
19. (continued)	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction. • Identify reproductive structures and their functions in angiosperms. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests. III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
19. (continued)	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify species that are competing for resources and predict outcomes of that competition. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival.		
	VII-1	Relate the Law of Conservation of Energy to energy transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
20. Explore a variety of habitats.			
21. Classify plants and animals according to their characteristics. Examples: color, shape, size, texture, coverings	III-1 Distinguish among the taxonomic groups by major characteristics. • Recognize the correct sequence or taxonomic classification of organisms from the most inclusive level to the least inclusive level—may include use of a chart to compare two species and to identify the classification level at which one species no longer shares common characteristics with other species. • Classify organisms into the five kingdoms based on recognizing two or more characteristics associated with organisms in a given kingdom.	X	
	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
21. (continued)	• Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		
	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
22. Describe evidences of prehistoric animals and their habitats. • Plant and animal fossils • Paintings and drawings of ancient life and habitats • Representations of prehistoric animals and habitats			
Heredity			
23. Describe physical similarities and differences between traits of parents and their offspring. Examples: color of eyes, height	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Interdependence			
24. Understand that living things share characteristics. Examples: growth, reproduction, response to environmental stimuli	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify reproductive structures and their functions in angiosperms.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
25. Explore the interactions of organisms and their environment. Examples: earthworms in soil, butterflies with plants, frogs in pond	II-1	Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	III-2	Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		
	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
25. (continued)	• Identify species that are competing for resources and predict outcomes of that competition. • Identify and define biotic and abiotic components of different environments. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
26. Describe the life cycles and basic needs (food, water, air, shelter, space/area) of familiar organisms.	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs).		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
26. (continued)	• Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.		
	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves.		
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Apply the concept of conservation and transformation of energy within and between and the environment—such as food chains, food webs, and energy pyramids.		
27. Explain how organisms are dependent upon each other for their survival. Examples: offspring depending upon parents, flowering plants depending on bees for pollination	II-1 Trace the transfer of matter and energy through biological systems. Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs).	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
27. (continued)	• Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes.		
	III-1 Distinguish among the taxonomic groups by major characteristics. • Classify organisms into the five kingdoms based on recognizing two or more characteristics associated with organisms in a given kingdom. • Recognize properly written scientific names using binomial nomenclature.		
	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits.		
	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
27. (continued)	• Explain why diversity within a species is important and how heritable traits ensure survival.		
28. Recognize technology in the school, home, and community. Examples: computer, pencil, refrigerator, Velcro, fire truck			
29. Explain how technology is applied to daily life. Examples: medicines, recycled products, computer games, telephone	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. VIII-1 Relate Newton's three laws of motion to real-world applications. VIII-2 Relate force to pressure in fluids. • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum and turgor pressure.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
30. Serve the school through a science-related project. Examples: school-wide recycling, tree planting			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
CONTENT STANDARDS Students will				
1. Demonstrate attitudes necessary for scientific investigation. - Curiosity - Readiness to learn from experiences - Willingness to postpone final judgment	I-1	Analyze the methods of science used to identify and solve problems.	X	
2. Use investigations in science to serve a variety of purposes. - Exploring their world - Verifying previous results - Comparing results	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
3. Use science skills. - Observing - Communicating - Classifying - Comparing - Predicting	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
4. Use critical-thinking skills in daily experiences. Examples: making choices, solving problems		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
5. Recognize shapes and patterns in nature and in things people make. Examples: spirals in shells, shapes of leaves, windows and bricks in a building	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Order the proper sequence of steps within the scientific process.	X	
6. Apply mathematical skills to scientific investigations. Examples: graphing, ordering, sequencing, measuring	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Order the proper sequence of steps within the scientific process.	X	
7. Explore standard and non-standard units of measurement.		X	
The Earth in Space			
8. Observe stars in relation to the Earth and the Universe. - Number (too many to count) - Brightness			
9. Describe the seasons of the year.		X	

2ND

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
The Dynamic Earth			
10. Make informed decisions about weather and describe its effect on their lives. - Safety precautions for severe weather - Clothing for protection from the weather	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.		
Matter			
11. Classify objects by physical properties. - Hardness - Softness - Buoyancy - Color	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
12. Classify matter by its state. - Solid - Liquid	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transcription and respiration.	X	
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
13. Recognize that some changes to objects can be reversed and some cannot. - Reversible Examples: heated ice to water, solid ice cream to liquid - Non-reversible Examples: broken glass, eroded rocks, dead plants	II-1 Trace the transfer of matter and energy through biological systems. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
Energy 14. Understand ways that the sun supports plant and animal life on Earth. Examples: heat, light	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
15. Investigate sources of energy. • Moving water • Food • Wind • Sun	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
15. (continued)	• Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
	VII-2 Relate waves to the transfer of energy.		
Force and Motion			
16. Discuss and make predictions about moving things. Examples: people, insects, birds, trees, doors, rain, fans, volleyballs, wagons, stars	VIII-1 Relate Newton's three laws of motion to real-world applications.	X	
	VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
17. Describe how things move or can be made to move. • Direction Examples: straight, curved, circular, back-and-forth, zigzag • Speed Examples: fast, slow • Forces Examples: wind, magnetism, water, gravity	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration. VIII-1 Relate Newton's three laws of motion to real-world applications. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.	X	1.
18. Recognize that force can be used to make objects move. Examples: pushing or pulling a lawn mower, colliding of objects, sailing a boat	VIII-1 Relate Newton's three laws of motion to real-world applications. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
19. Explore the forces that move objects. Examples: gravity, magnetism, electricity			
Diversity			
20. Recognize that the behavioral and physical characteristics of plants and animals help them survive in their habitat. - Adaptation of plants and animals Examples: color, size, shape, coverings - Locomotion, migration, hibernation of animals	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.	X	
	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
20. (continued)	IV-1	Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring.		
	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify species that are competing for resources and predict outcomes of that competition. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival.		
21. Compare plants and animals in their immediate surroundings with those in other habitats.	III-2	Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.	X	
	III-3	Differentiate structures, functions, and characteristics of animals. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
21. (continued)	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments. • Explain why diversity within a species is important and how heritable traits ensure survival.		
22. Compare animals that are extinct with those that exist today. Examples: stegosaurus and lizard, pterodactyl and bird			
23. Compare likenesses and differences in plants and animals.	III-1 Distinguish among the taxonomic groups by major characteristics. • Recognize the correct sequence or taxonomic classification of organisms from the most inclusive level to the least inclusive level—may include use of a chart to compare two species and to identify the classification level at which one species no longer shares common characteristics with other species. • Classify organisms into the five kingdoms based on recognizing two or more characteristics associated with organisms in a given kingdom.	X	

2ND

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
23. (continued)	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests. III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		

2ND

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Heredity			
24. Give evidence that offspring produced by plants or animals are similar to the parent at some stage of their development. Examples: size, shape, color	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares.	X	
25. Explain how the behavioral and physical characteristics of plants and animals help them survive in their habitat. Examples: chameleon changing color, cactus storing water	III-2 Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests. III-3 Differentiate structures, functions, and characteristics of animals. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.	X	

2ND

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Interdependence			
26. Explain how plants and animals often interact to meet the needs of both groups. Examples: animals using plants for shelter and nesting, animals eating plants or other animals for food, insects or other animals pollinating plants	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids.		
	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		
27. Describe natural and human changes in the environment. Examples: natural disasters, pollution, improvement of habitats, destruction of habitats	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
27. (continued)	• Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
28. Recognize technology in the school, home, and community. Examples: computer, pencil, refrigerator, Velcro, fire truck			
29. Explain how technology is applied to daily life. Examples: medicines, recycled products, computer games, telephone, agriculture, aquaculture, horticulture	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. VIII-1 Relate Newton's three laws of motion to real-world applications.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
29. (continued)	VIII-2 Relate force to pressure in fluids. • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum and turgor pressure.		
30. Serve the community through a science-related project. Example: make decorative items from recycled materials for nursing homes			
31. Recognize the importance of science to many careers.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
CONTENT STANDARDS Students will			
1. Utilize techniques essential to scientific investigation. - Recognizing inconsistencies - Developing new questions - Monitoring methods - Selecting data samples - Demonstrating critical thinking - Recording observations - Predicting possible results - Classifying objects, events, and organisms	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	
2. Exhibit habits necessary for responsible scientific investigation. - Curiosity - Creativity - Honesty - Patience - Attention to detail - Objectivity	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Define and identify examples of hypotheses.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
2. (continued)	• Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
3. Communicate scientific content effectively. Examples: speak and write about it, illustrate it	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts.	X	
4. Construct mental, verbal, or physical representations of ideas, objects, and events.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Define and identify examples of hypotheses.	X	
5. Recognize the effects of manipulated and controlled factors on the outcomes of events.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
6. Demonstrate the appropriate use of instruments and procedures when learning new information. Examples: practicing safety procedures; storing and transporting microscopes, spring scales, and thermometers	I-1 Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
7. Apply mathematical knowledge and skills to scientific investigations. - Computation - Probability - Graphing - Fractions	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
The Universe				
8. Recognize that the Earth is one of several planets that orbit the sun and that the moon orbits the Earth.	VIII-1	Relate Newton's three laws of motion to real-world applications.	X	
9. Know that space exploration confirms the Earth is spherical (round) in shape.				
10. Understand that telescopes are used to magnify the appearance of distant objects in the sky.	I-1	Analyze the methods of science used to identify and solve problems. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
The Earth in Space				
11. Recognize that the appearance of the moon changes.			X	
12. Understand that the movement of the Earth determines the seasons and the length of day and night.	VII-1	Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.	X	
	VII-2	Relate waves to the transfer of energy.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
The Dynamic Earth				
13. Use appropriate tools to recognize and describe different types of the Earth's materials. Examples: hand lens, scratch plate	I-1	Analyze the methods of science used to identify and solve problems. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
14. Recognize that natural forces affect the surface of the Earth. - Slow forces Examples: waves, wind, water, ice - Fast forces Examples: earthquakes, volcanoes, hurricanes	VII-2	Relate waves to the transfer of energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.	X	
	VIII-2	Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
15. Recognize that human-made activities affect the surface of the Earth. - Excavation - Deforestation/Reforestation - Mining - Farming - Draining wetlands/Creating wetlands	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		
16. Investigate rocks and minerals. - Observing physical characteristics Examples: color, weight, luster, texture - Comparing various rocks and minerals - Grouping, using student's own classification system - Studying uses of rocks and minerals	I-1 Analyze the methods of science used to identify and solve problems. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
17. Identify geological features of the Earth. - Sand dunes - Mountains - Valleys - Bodies of water			
18. Relate events in daily life to aspects of the water cycle. Examples: water condensing on a glass of iced tea, water evaporating from a glass of water	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.		
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		
19. Understand that the atmosphere is made of a variety of components. - Gases - Dust	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.		
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Matter			
20. Describe observable properties of the states of matter. Examples: solids have definite shape, liquids and gases take the shapes of their containers	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration. II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
21. Describe characteristics of objects. - Color - Flexibility - Composition - Shape - Size - Texture - Weight - Luster		X	
22. Identify the difference between chemical and physical changes. Examples: chemical change—rusting nails physical change—melting wax			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
23. Recognize that some materials may respond differently to the same action. Example: salt dissolves in water and sand does not			X	
24. Recognize that matter occupies space and has mass.	II-2	Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
Energy				
25. Explain ways that energy is useful and important. Examples: to do work, to heat water	VII-1	Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
26. Recognize things and processes that give off heat. Examples: sun, fire, lamp; rubbing surfaces, sawing wood, bending wire	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.	X	
27. Explain the effects of heat on matter.	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
27. (continued)	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
28. Explore sound. - Characteristics - Production of sound - Transmission of sound	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Force and Motion			
29. Understand that gravity is a force that pulls objects toward the Earth.	VIII-1 Relate Newton's three laws of motion to real-world applications.	X	
30. Demonstrate that light travels from one place to another. Examples: illuminating objects, forming shadows	VII-2 Relate waves to the transfer of energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
31. Demonstrate that motion is a result of applying forces that are unequal. Examples: motion in a tug-of-war game, motion of a see-saw	VIII-1 Relate Newton's three laws of motion to real-world applications.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Diversity			
32. Classify plants and animals according to their features. - Physical - Structural - Behavioral	III-1 Distinguish among the taxonomic groups by major characteristics. • Recognize the correct sequence or taxonomic classification of organisms from the most inclusive level to the least inclusive level—may include use of a chart to compare two species and to identify the classification level at which one species no longer shares common characteristics with other species. • Classify organisms into the five kingdoms based on recognizing two or more characteristics associated with organisms in a given kingdom.		
	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
32. (continued)	• Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		
	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
33. Examine how fossils provide evidence of prehistoric life. Example: fern fossil in coal or shale		X	
Heredity			
34. Examine inherited attributes of living things. - Physical features Examples: offspring resembling parents, coloration for camouflage - Developmental patterns Example: metamorphosis of the butterfly	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Cells			
35. Become aware that the smallest unit of life is called a cell.	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Identify and define similarities and differences between plant and animal cells.		
36. Recognize that living things are made of one or more cells.	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Identify and define similarities and differences between plant and animal cells. • Distinguish and identify examples of cellular organization at the cell, tissue, organ, system, and organism level.		
Interdependence			
37. Understand that species depend on one another and on their environment for survival. Example: plants and animals in a food chain	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
37. (continued)	III-3 Differentiate structures, functions, and characteristics of animals. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resources and predict outcomes of that competition. • Identify and define biotic and abiotic components of different environments. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
38. Recognize helpful and harmful effects of organisms. Examples: mold can be used to make penicillin, mold can cause food to decay	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.	X	
39. Describe how various organisms satisfy their needs (food, water, air, shelter, space) within their environments.	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
39. (continued)	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify species that are competing for resource and predict outcomes of that competition. • Identify and define biotic and abiotic components of different environments. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		
40. Understand the relationship of air, water, and soil to life on Earth.	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
41. Describe how humans depend upon plants and animals. Examples: trees provide wood, sheep provide wool		X	
42. Recognize the use of technology to improve uniformity, quantity, quality, and cost-effectiveness of manufactured products.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
43. Recognize relationships among science, technology, and society. Examples: chemical fertilizers increase crop yield, lasers make possible new surgical procedures	III-2	Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.	X	
	IV-1	Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.		
	IV-2	Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
43. (continued)	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
43. (continued)	• Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		
44. Become aware of ways to deal with discarded products that create waste disposal problems. - Reuse - Redesign - Recycle			
45. Relate goods and services to the technologies that make them available. - Communication - Health care - Entertainment - Sanitation	VII-2 Relate waves to the transfer of energy. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
46. Apply scientific knowledge and processes from one domain of science (Earth and Space, Physical, Life) to other fields of study. Example: Alexander Graham Bell and his contribution to technology	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
46. (continued)	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
	VIII-2 Relate force to pressure in fluids. • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		
47. Recognize the importance of science to many careers.			
48. Serve the community through a science-related project. Examples: school-wide recycling, tree planting			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
CONTENT STANDARDS Students will			
1. Utilize techniques essential to scientific investigation. - Recognizing inconsistencies - Developing new questions - Monitoring methods - Selecting data samples - Demonstrating critical thinking - Recording observations - Predicting possible results - Classifying objects, events, and organisms	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	
2. Exhibit habits necessary for responsible scientific investigation. - Curiosity - Creativity - Honesty - Patience - Attention to detail - Objectivity	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Define and identify examples of hypotheses.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
2. (continued) - Curiosity - Creativity - Honesty - Patience - Attention to detail - Objectivity		• Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
3. Communicate scientific content effectively. Examples: speak and write about it, illustrate it	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts.	X	
4. Construct mental, verbal, or physical representations of ideas, objects, and events.	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Define and identify examples of hypotheses.	X	
5. Recognize the effects of manipulated and controlled factors on the outcomes of events.	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
6. Demonstrate the appropriate use of instruments and procedures when learning new information. Examples: practicing safety procedures, storing and transporting microscopes	I-1 Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
7. Apply mathematical knowledge and skills to scientific investigations. - Computation - Probability - Graphing - Fractions and decimals - Arithmetic mean	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
The Universe			
8. Develop initial knowledge of stars, planets, and moons in the Universe.		X	
9. Compare stars and planets. - Appearance - Movement		X	
10. Know that our solar system is a sun-centered system.			
11. Distinguish appearances from facts regarding the movement of objects across the sky. Examples: sun appearing to rise and set when it is fixed, constellations appearing to move when they are fixed		X	
12. Discuss what makes the sun a star.		X	
The Earth in Space			
13. Relate the movements of the moon and the Earth to the tides.		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
14. Develop initial understanding about the relative scale of the Earth. - To the planets - To the sun - To the moon	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.	X	
15. Associate the passage of time with the apparent changes in the location and shape of heavenly bodies. Examples: apparent moving of sun across the sky during day, apparent change in shape of moon during month	I-1	Analyze the methods of science used to identify and solve problems. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
16. Explain the relationship between the rotation of the Earth on its axis and the day-and-night cycle.			X	
The Dynamic Earth				
17. Recognize air as a permanent substance that surrounds us, takes up space, and is felt as wind.	II-1	Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
The Dynamic Earth				
17. Recognize air as a permanent substance that surrounds us, takes up space, and is felt as wind. (continued)	II-2	Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
18. Explain the use of weather instruments in predicting and recording weather. - Barometer - Rain gauge - Hygrometer - Wind vane/anemometer - Thermometer	I-1	Analyze the methods of science used to identify and solve problems. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
19. Identify the positive and negative impacts of weather on the environment. Example: increased crop production after a flood	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
20. Understand aspects of weather. - Precipitation Examples: rain, snow, sleet, hail, dew - Tornadoes - Hurricanes - Thunder/lightning - Temperature	II-1	Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-4	Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
21. Relate events in daily life to aspects of the water cycle. Examples: water condensing as dew on grass and windshield, water evaporating from bird baths, mist rising from a lake	II-1	Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-2	Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
22. Describe the geographic features of the ocean floor. - Valley - Trench - Ocean ridge - Mountain - Continental shelf - Continental slope				
23. Identify the living communities in the ocean.	III-2	Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.	X	
	III-3	Differentiate structures, functions, and characteristics of animals. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify species that are competing for resources and predict outcomes of that competition.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
23. (continued)	• Identify and define biotic and abiotic components of different environments. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival.		
	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids.		
24. Understand the importance of the oceans in our lives. Examples: transportation, salt, food, recreation		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
25. Compare salt-water communities. - Oceans - Gulfs - Beaches - Estuaries - Marshes	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		
	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
25. (continued) - Oceans - Gulfs - Beaches - Estuaries - Marshes	• Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify species that are competing for resource and predict outcomes of that competition. • Identify and define biotic and abiotic components of different environments. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival.		
Matter			
26. Explain that combining two or more materials may change properties of matter. Examples: vinegar with baking soda, yeast with flour and water	II-1 Trace the transfer of matter and energy through biological systems. • Trace the flow of energy through food chains, food webs, and energy pyramids.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
26. (continued) Examples: vinegar with baking soda, yeast with flour and water	• Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.		
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
27. Describe physical and chemical changes.	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
27. (continued)	II-4	Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
	VII-1	Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.		
28. Recognize that properties of materials differ. - Solubility - Buoyancy/Density - Transparency - Conductivity	II-2	Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
	II-3	Apply information from the periodic table and make predictions using the organization of the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
28. Recognize that properties of materials differ. (continued) - Solubility - Buoyancy/Density - Transparency - Conductivity	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
29. Relate actions on objects to changes in those objects. Examples: filling a balloon with air expands it, flipping a switch turns on a light	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
29. (continued)	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. VIII-1 Relate Newton's three laws of motion to real-world applications. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems-such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Energy			
30. Compare the use of various forms of energy.	II-1 Trace the transfer of matter and energy through biological systems. • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes.		
	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy-mechanical, electrical, chemical, light, sound, and heat-can be transformed from one form to another.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Energy			
30. (continued)	• Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
	VII-2 Relate waves to the transfer of energy. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
31. Explain the differences between conductors and non-conductors of heat.	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases.	X	
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
32. Explain how energy from the sun is used. Examples: for plants to make food, for water to be heated	II-1	Trace the transfer of matter and energy through biological systems. • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-2	Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		
	VII-1	Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
32. (continued) Examples: for plants to make food, for water to be heated	VII-2 Relate waves to the transfer of energy. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
33. Understand that fossil fuels were formed under special conditions and cannot be replaced.			
34. Associate friction with objects charged with static electricity.			
35. Compare simple series and parallel circuits.		X	
Force and Motion			
36. Explain how force affects speed and direction of motion.	VIII-1 Relate Newton's three laws of motion to real-world applications.	X	
37. Recognize that forces can act from a distance. Examples: magnets moving each other without touching, moon's gravitational pull on the tides	VIII-1 Relate Newton's three laws of motion to real-world applications. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
37. (continued) Examples: magnets moving each other without touching, moon's gravitational pull on the tides	• Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.	X	
38. Recognize that distance affects the strength of force between objects. Example: magnets attracting more objects by moving closer		X	
39. Investigate and compare simple and compound machines.			
40. Understand properties of lights. - Reflection - Refraction	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Diversity 41. Classify living things using various characteristics.	III-1 Distinguish among the taxonomic groups by major characteristics. • Recognize the correct sequence or taxonomic classification of organisms from the most inclusive level to the least inclusive level—may include use of a chart to compare two species and to identify the classification level at which one species no longer shares common characteristics with other species. • Classify organisms into the five kingdoms based on recognizing two or more characteristics associated with organisms in a given kingdom.	X	
	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
41. (continued)	• Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		
	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment-such as protective coloration, mimicry, claws, beaks, etc.		
	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
42. Examine fossil evidence for change in organisms over time. Examples: dinosaurs became extinct, some plant species are extinct or have changed, horseshoe crabs have remained relatively unchanged			
Heredity			
43. Examine behaviors of living things. - Inherited - Learned	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems.		
Cells			
44. Describe cells as observed with the aid of various technologies. Examples: seen in pictures, viewed under a microscope, observed in videos	I-1 Analyze the methods of science used to identify and solve problems. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
44. (continued)	• Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation. V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Identify and define similarities and differences between plant and animal cells. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells. • Describe cell locomotion by means of cilia and flagella and recognize some organisms that depend on one or the other of these means of locomotion. • Identify cell organelles—may include graphic representations. V-2 Differentiate between mitosis and meiosis. • Define, contrast, and compare mitosis and meiosis—may include events needed to prepare the cell for these processes.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
45. Understand that cells are specialized according to their functions.	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Identify and define similarities and differences between plant and animal cells. • Describe cell locomotion by means of cilia and flagella and recognize some organisms that depend on one or the other of these means of locomotion. • Identify cell organelles—may include graphic representations. • Distinguish and identify examples of cellular organization at the cell, tissue, organ, system, and organism level.	X	
	V-2 Differentiate between mitosis and meiosis. • Define, contrast, and compare mitosis and meiosis—may include events needed to prepare the cell for these processes. • Describe the purpose of mitotic and meiotic divisions during different life stages of organisms—such as asexual and sexual reproduction and growth and repair.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Interdependence			
46. Understand that organisms depend on one another and on their environment for survival. Examples: wind and animals pollinating plants, animals adapting and migrating in response to environment	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids.	X	
	III-3 Differentiate structures, functions, and characteristics of animals. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resource and predict outcomes of that competition. • Identify and define biotic and abiotic components of different environments.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Interdependence			
46. Understand that organisms depend on one another and on their environment for survival. (continued) Examples: wind and animals pollinating plants, animals adapting and migrating in response to environment	• Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.	X	
47. Recognize that uniformity, quantity, quality, and cost-effectiveness of manufactured products improve with the use of technology.			
48. Recognize relationships among science, technology, and society. Examples: agriculture, medicine, careers	III-2 Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.	X	
	IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next-may include family pedigrees and monohybrid Punnett squares.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
48. (continued)	• Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.		
	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.		
	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
48. (continued)	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.	X	
	VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		
49. Become aware of ways to deal with discarded products that create waste disposal problems. - Reuse - Redesign - Recycle			

Alabama Course of Study: Science: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
50. Relate goods and services to the technologies that make them available. - Communication - Health care - Entertainment - Sanitation	VII-2 Relate waves to the transfer of energy. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
51. Apply scientific knowledge and processes from one domain of science (Earth and Space, Physical, Life) to other fields of study. Examples: rock color to Indian art	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
	VIII-2 Relate force to pressure in fluids. • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		

Alabama Course of Study: Science: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
52. Recognize the importance of science to many careers.			
53. Serve the community through a science-related project. Example: school-wide recycling, tree planting		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
CONTENT STANDARDS Students will			
1. Utilize techniques essential to scientific investigation. - Recognizing inconsistencies - Developing new questions - Monitoring methods - Selecting data samples - Demonstrating critical thinking - Recording observations - Predicting possible results - Classifying objects, events, and organisms	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	
2. Exhibit habits necessary for responsible scientific investigation. - Curiosity - Creativity - Honesty - Patience - Attention to detail - Objectivity	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Define and identify examples of hypotheses.	X	

	Alabama Course of Study: Science		*Alabama High School Graduation Exam*	Stanford 9	Local
2.	(continued)		• Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
3.	Communicate scientific content effectively. Examples: speak and write about it, illustrate it	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts.	X	
4.	Construct mental, verbal, or physical representations of ideas, objects, and events.	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Define and identify examples of hypotheses.	X	
5.	Recognize the effects of manipulated and controlled factors on the outcomes of events.	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
6. Demonstrate the appropriate use of instruments and procedures when learning new information. Examples: practicing safety procedures, storing and transporting microscopes	I-1	Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
7. Apply mathematical knowledge and skills to scientific investigations. - Computation - Probability - Graphing - Variables - Fractions and decimals - Arithmetic mean, mode, median	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
The Universe			
8. Understand that the size of a light source appears to vary with distance from the source. Examples: car lights, flashlight, star, sun		X	
9. Know that patterns of stars remain the same even though patterns appear to move across the sky.		X	
10. Explain the variety of components of the solar system.	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
The Earth in Space			
11. Associate the revolution of the Earth around the sun with the seasons.		X	
12. Develop an understanding of the relationship between the moon and the tides.		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
The Dynamic Earth			
13. Explain methods that protect the limited natural resources of the Earth. Examples: conservation, recycling			
14. Relate natural forces to fast and slow changes in the Earth's surface. Examples: stress on rocks causes earthquakes, flowing water causes erosion	VII-2 Relate waves to the transfer of energy. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy. VIII-1 Relate Newton's three laws of motion to real-world applications. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)	X	
15. Understand that human activities have an impact on ecosystems. - Excavation - Deforestation/Reforestation - Mining - Farming - Improving habitats - Draining wetlands	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
16. Describe basic components of the rock cycle. - Erosion - Transportation - Deposition	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
17. Understand the geological features of the Earth. Examples: ice caps, folds, faults		X	
18. Understand the water cycle.	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs).	X	
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		
19. Differentiate between weather and climate.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
20. Identify and explain conditions that affect weather. - High pressure - Low pressure - Fronts		X	
21. Understand the symbols of a weather map.		X	
22. Explain the use of technology in predicting and recording the weather. - Satellites - Radar	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs).	X	
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		
Matter			
23. Describe chemical and physical changes that occur when two or more materials are combined. Examples: gas released when baking soda and vinegar are combined, milkshake formed when ice cream and milk are combined	II-1 Trace the transfer of matter and energy through biological systems. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
23. (continued)	II-3	Apply information from the periodic table and make predictions using the organization of the periodic table. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.		
	II-4	Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
	VII-1	Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
24. Determine properties of objects and materials. - Conductivity - Density - Magnetism - Solubility - Transparency - Rigidity - Flexibility	II-2	Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
	II-3	Apply information from the periodic table and make predictions using the organization of the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases.		
	II-4	Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
Energy				
25. Become aware that when two objects of different temperatures are placed together, they will reach the same temperature.	II-2	Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
	VII-2	Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media.		
26. Explore the production, consumption, transformation, and conservation of energy. - Electrical energy - Mechanical energy - Heat energy - Light energy - Chemical energy	II-1	Trace the transfer of matter and energy through biological systems. • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes.		
	VII-1	Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
26. (continued)	• Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
Force and Motion			
27. Understand that gravity is a force that pulls everything toward the center of a spherical Earth.	VIII-1 Relate Newton's three laws of motion to real-world applications.	X	
28. Realize that a gravitational force is created by the components of the Universe.		X	
29. Identify forces required to make objects interact, change directions, or stop.	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
29. (continued)	VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		
Diversity			
30. Describe the behavioral interactions within the same species and among different species within an ecosystem. - Predator/Prey - Coexistence - Cooperation - Competition	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify species that are competing for resource and predict outcomes of that competition. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.	X	
31. Invent classification systems that serve specific purposes. Examples: animals that are pets and non-pets, objects that are edible and non-edible	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs).	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
31. (continued)	III-1	Distinguish among the taxonomic groups by major characteristics. • Recognize the correct sequence or taxonomic classification of organisms from the most inclusive level to the least inclusive level—may include use of a chart to compare two species and to identify the classification level at which one species no longer shares common characteristics with other species. • Classify organisms into the five kingdoms based on recognizing two or more characteristics associated with organisms in a given kingdom. • Recognize properly written scientific names using binomial nomenclature.		
	III-3	Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits.		
	III-3	Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
31. (continued)	• Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells.		
32. Explain why living organisms are classified into five kingdoms.	III-1 Distinguish among the taxonomic groups by major characteristics. • Classify organisms into the five kingdoms based on recognizing two or more characteristics associated with organisms in a given kingdom.	X	
Heredity			
33. Associate physical characteristics with family lineage. Examples: height, hair color, eye color	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
34. Describe the difference between a hybrid and a purebred organism.	IV-2	Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.	X	
Cells				
35. Identify the basic parts of a cell and their functions. - Nucleus - Cytoplasm - Chloroplast (plants) - Cell membrane - Cell wall (plants)	IV-2	Explain how the DNA molecule transfers genetic information from parent to offspring. • Describe the relationships among DNA, genes, and chromosomes. • Describe in basic terms the structure and function of DNA.		
	V-1	Distinguish relationships among cell structures, functions, and organization in living organisms. • Identify and define similarities and differences between plant and animal cells. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
35. (continued)	• Describe cell locomotion by means of cilia and flagella and recognize some organisms that depend on one or the other of these means of locomotion. • Identify cell organelles—may include graphic representations. • Distinguish and identify examples of cellular organization at the cell, tissue, organ, system, and organism level.		
	V-2 Differentiate between mitosis and meiosis. • Define, contrast, and compare mitosis and meiosis—may include events needed to prepare the cell for these processes.		
36. Identify the basic life processes that occur in cells. - Growth - Energy - Reproduction - Waste elimination - Adaptation to the environment	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
36. (continued)	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Define and identify representations of diffusion and osmotic systems and what substances are transported by these processes—may include graphic representations. • Recognize differences between active and passive transport of substances and the energy requirements associated with these transport systems. • Identify cell organelles—may include graphic representations. V-2 Differentiate between mitosis and meiosis. • Define, contrast, and compare mitosis and meiosis—may include events needed to prepare the cell for these processes. • Describe the purpose of mitotic and meiotic divisions during different life stages of organisms—such as asexual and sexual reproduction and growth and repair.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
37. Understand that tissues are groups of cells that are similar in appearance and function.	V-1	Distinguish relationships among cell structures, functions, and organization in living organisms. • Identify and define similarities and differences between plant and animal cells. • Distinguish and identify examples of cellular organization at the cell, tissue, organ, system, and organism level.		
38. Understand that cells comprise tissue and tissues comprise organs, which together form systems.	V-1	Distinguish relationships among cell structures, functions, and organization in living organisms. • Distinguish and identify examples of cellular organization at the cell, tissue, organ, system, and organism level.		
Interdependence				
39. Understand that special relationships enable some organisms to survive. Examples: predation, parasitism, mutualism	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resource and predict outcomes of that competition. • Identify and define biotic and abiotic components of different environments.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
39. (continued)	• Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		
40. Recognize that changes in habitats may harm and/or help organisms. - Human changes Examples: river diversion, dam construction, reforestation - Natural changes Examples: floods, droughts, earthquakes, volcanoes	III-2 Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.	X	
	III-3 Differentiate structures, functions, and characteristics of animals. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
40. (continued)	• Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		
41. Recognize that uniformity, quantity, quality, and cost-effectiveness of manufactured products improve with the use of technology.			
42. Recognize relationships among science, technology, and society. Examples: agriculture, medicine, careers		X	
43. Become aware of ways to deal with discarded products that create waste disposal problems. - Reuse - Redesign - Recycle	III-2 Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
43. (continued)	IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur. IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
43. (continued)	• Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
	VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
44. Relate goods and services to the technologies that make them available. - Communication - Health care - Entertainment - Sanitation	VII-2 Relate waves to the transfer of energy. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
45. Apply scientific knowledge and processes from one domain of science (Earth and Space, Physical, Life) to other fields of study. Example: the effect of deforestation on natural sources of medicine	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
	VIII-2 Relate force to pressure in fluids. • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
46. Recognize the importance of science to many careers.	VII-2	Relate waves to the transfer of energy. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
	II-1	Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-4	Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
	VIII-2	Relate force to pressure in fluids. • Apply the concept of fluid pressure to biological systems-such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
47. Serve the community through a science-related project. Examples: school-wide recycling, tree planting			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
CONTENT STANDARDS Students will **Nature of Science**			
1. Explain the need for peer review of scientific investigations.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	
2. Understand the need for continual re-evaluation of knowledge.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Define and identify examples of hypotheses.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
2. (continued)	• Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, optical instruments to conduct an investigation.		
3. Discuss the limitations of scientific study.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts.		
4. Cite examples of the global nature of the scientific enterprise.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Define and identify examples of hypotheses.		
5. Discuss the ethical issues of science. Examples: use of animals and humans in research, use of military technology	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Habits of Science			
6. Exhibit habits necessary for responsible scientific investigation. - Curiosity - Creativity - Imagination - Honesty - Patience - Logical reasoning - Attention to detail - Critical thinking		X	
7. Evaluate the reasonableness of an answer to a scientific problem.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Define and identify examples of hypotheses.	X	
8. Use technology for investigation and communication in science.	I-1 Analyze the methods of science used to identify and solve problems. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Skills of Science			
9. Use basic scientific process/thinking skills as developmentally appropriate. - Observing - Interpreting - Classifying - Measuring	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
10. Demonstrate developmentally appropriate applications of higher-order science process/thinking skills.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
10. (continued) - Recognizing cause and effect - Designing experiments to test ideas - Planning procedures for investigations - Controlling and manipulating variables	• Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
11. Apply manipulative skills to the scientific process. - Maintenance of accurate records - Correct use of laboratory procedures and techniques - Effective communication or display of results	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
12. Apply appropriate units and significant figures to express measurements and calculated results.	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.		
13. Apply mathematical concepts and skills in science and in scientific investigations. - Probability - Graphing skills - Exponential notation - Variable notation - Integers - Fractions, decimals, and percents - Ratio and proportion - Arithmetic mean, mode, and median	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.		
14. Use scientific equipment, apparatus, and technologies safely and efficiently in investigations. Examples: thermometers, microscopes, balances, computers, electronic probe-ware	I-1	Analyze the methods of science used to identify and solve problems. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
15. Use proper procedures in the handling and care of living organisms and specimens derived from living things.		X	
The Earth in Space			
16. Describe the spheres of the Earth and their composition. - Lithosphere - Hydrosphere - Atmosphere - Exosphere	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.		
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		
	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
16. (continued)	VII-1	Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
17. Explain how the resources of Earth support a variety of life. Examples: rock, soil, water, air	II-1	Trace the transfer of matter and energy through biological systems. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
17. (continued)	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
	VII-2 Relate waves to the transfer of energy. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
	VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)		
18. Expand their understanding of gravity. - Gravitational force pulling toward a center of mass - Gravitational force extending into space	VIII-1 Relate Newton's three laws of motion to real-world applications.		
19. Relate the lunar orbit to the phases of the moon and gravitational effects produced on the Earth.	VIII-1 Relate Newton's three laws of motion to real-world applications.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
20. Explain factors that determine seasons on the Earth. - Tilt of the Earth - Revolution of the Earth around the sun	VIII-1 Relate Newton's three laws of motion to real-world applications.	X	
21. Describe the forms and functions of technology that monitor the Earth and outer space. Example: weather satellites used to monitor storms and other weather systems	I-1 Analyze the methods of science used to identify and solve problems. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
	VIII-1 Relate Newton's three laws of motion to real-world applications.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
Matter				
22. Understand matter in terms of mass and volume.	II-2	Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
	II-3	Apply information from the periodic table and make predictions using the organization of the periodic table. • Determine the number of protons, neutrons, electrons, and mass of an element using the periodic table.		
23. Distinguish between mass and weight.	II-3	Apply information from the periodic table and make predictions using the organization of the periodic table. • Determine the number of protons, neutrons, electrons, and mass of an element using the periodic table.		
	VIII-1	Relate Newton's three laws of motion to real-world applications.		
24. Differentiate macroscopic (observable) characteristics of solids, liquids, and gases.	II-2	Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
24. (continued)	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
25. Distinguish between physical and chemical changes in matter.	II-1 Trace the transfer of matter and energy through biological systems. • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
25. (continued)	II-3	Apply information from the periodic table and make predictions using the organization of the periodic table. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.		
	II-4	Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
	V-1	Distinguish relationships among cell structures, functions, and organization in living organisms. • Define and identify representations of diffusion and osmotic systems and what substances are transported by these processes—may include graphic representations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
25. (continued)	• Recognize differences between active and passive transport of substances and the energy requirements associated with these transport systems. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)		
Energy			
26. Distinguish between static and current electricity.		X	
27. Describe the relationship between electricity and magnetism.		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
28. Compare simple series and parallel circuits.				
Force and Motion				
29. Describe the relationship of magnitude of force to distance between two objects. - Magnets (magnetic force) - Charged objects (electrical force) - Masses (gravitational force)	VIII-1	Relate Newton's three laws of motion to real-world applications.	X	
30. Develop an understanding that motion of an object is always judged relative to some other object or point.			X	
31. Relate energy and force to work.	VIII-2	Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)	X	
32. Demonstrate ways that simple machines can change force.			X	
33. Analyze simple machines for mechanical advantage and efficiency.			X	
34. Compare simple machines to the skeletal and muscular systems of the "human machine."				

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Diversity			
35. Compare the distinguishing characteristics of organisms. - Anatomical features - Methods of locomotion - Methods of reproduction - Patterns of development	III-1 Distinguish among the taxonomic groups by major characteristics. • Recognize the correct sequence or taxonomic classification of organisms from the most inclusive level to the least inclusive level—may include use of a chart to compare two species and to identify the classification level at which one species no longer shares common characteristics with other species. • Classify organisms into the five kingdoms based on recognizing two or more characteristics associated with organisms in a given kingdom. • Recognize properly written scientific names using binomial nomenclature.	X	
	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
35. (continued)	• Identify reproductive structures and their functions in angiosperms. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		
	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring.		
	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
35. (continued)	V-1	Distinguish relationships among cell structures, functions, and organization in living organisms. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells. • Describe cell locomotion by means of cilia and flagella and recognize some organisms that depend on one or the other of these means of locomotion. • Identify cell organelles—may include graphic representations. • Distinguish and identify examples of cellular organization at the cell, tissue, organ, system, and organism level.		
	V-2	Differentiate between mitosis and meiosis. • Describe the purpose of mitotic and meiotic divisions during different life stages of organisms—such as asexual and sexual reproduction and growth and repair.		
	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
36. Understand how different organisms get their food and convert it to useful forms of energy.	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes.	X	
	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify species that are competing for resource and predict outcomes of that competition. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of population dynamics and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
36. (continued)	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
37. Recognize the effects of geography on the diversity of flora and fauna.	III-2 Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.	X	
	III-3 Differentiate structures, functions, and characteristics of animals. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
37. (continued)	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
Cells			
38. Understand the cell theory.			
39. Compare structure and function of plant and animal cells.	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Identify and define similarities and differences between plant and animal cells. • Identify cell organelles—may include graphic representations.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
39. (continued)	V-2 Differentiate between mitosis and meiosis. • Describe the purpose of mitotic and meiotic divisions during different life stages of organisms—such as asexual and sexual reproduction and growth and repair.		
40. Explain basic life functions of single cell organisms. - Movement - Growth/Repair - Reproduction - Ingestion - Digestion - Respiration - Excretion	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.	X	
	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Define and identify representations of diffusion and osmotic systems and what substances are transported by these processes—may include graphic representations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
40. (continued)	• Recognize differences between active and passive transport of substances and the energy requirements associated with these transport systems. • Identify and define similarities and differences between plant and animal cells. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells. • Describe cell locomotion by means of cilia and flagella and recognize some organisms that depend on one or the other of these means of locomotion. • Identify cell organelles—may include graphic representations. V-2 Differentiate between mitosis and meiosis. • Describe the purpose of mitotic and meiotic divisions during different life stages of organisms—such as asexual and sexual reproduction and growth and repair.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
41. Relate changes in the endocrine system to human growth and development.			
42. Describe the components and basic functions of the skeletal and muscular systems in the human body.			
Interdependence			
43. Explain interdependence among humans, between plants and animals, and among ecosystems.	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids.	X	
	III-2 Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		
	III-3 Differentiate structures, functions, and characteristics of animals. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
43. (continued)	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resources and predict outcomes of that competition. • Identify and define biotic and abiotic components of different environments. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
44. Differentiate between the two main interconnected global food webs. - Terrestrial - Aquatic	II-1	Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	III-2	Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		
	III-3	Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
44. (continued)	• Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify species that are competing for resources and predict outcomes of that competition. • Identify and define biotic and abiotic components of different environments. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
45. Describe the Earth's biomes and the interdependence of their populations. Examples: fresh water, marine, estuary, forest, grassland, mountain, tundra, desert, chaparral	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		
	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
45. (continued)	• Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resources and predict outcomes of that competition. • Identify and define biotic and abiotic components of different environments. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
45. (continued)	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
Career and Other Fields of Study			
46. Apply scientific knowledge and processes from one domain of science (Earth and Space, Physical, Life) to another and to other fields of study.	II-1 Trace the transfer of matter and energy through biological systems. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes.	X	
	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
46. (continued)	VIII-2	Relate force to pressure in fluids. • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		
47. Recognize the importance of science to many careers.			X	
Science, Technology, and Society				
48. Place scientific discoveries in historical, social, economical, and ethical perspective.	III-2	Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.	X	
	IV-1	Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*		Stanford 9	Local
48. (continued)	IV-2	Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.		
	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		
	VII-1	Relate the Law of Conservation of Energy to energy transformations. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
49. Discuss the impact of technology on science, human history, and/or society.	III-2	Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
49. (continued)	IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
49. (continued)	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
50. Discuss the limits of technology in fulfilling human needs.		X	
51. Analyze the constraints on design of technology. - Physical - Ethical - Aesthetic - Societal - Economic	IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.		
	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Describe the relationships among DNA, genes, and chromosomes.		

Alabama Course of Study: Science		*Alabama High School Graduation Exam*	Stanford 9	Local
51. (continued)		• Describe the basic terms the structure and function of DNA. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.		
	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		
52. Explain the importance of testing technology and products of technology in a controlled setting before submission to the general public.	IV-1	Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
52. (continued)	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Describe the relationships among DNA, genes, and chromosomes. • Describe the basic terms the structure and function of DNA. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		
53. Serve the community through a science-related project. Examples: school-wide recycling, tree planting, water quality testing, creating a nature trail or an environmental newsletter			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
CONTENT STANDARDS			
Students will			
Nature of Science			
1. Explain the need for peer review of scientific investigations.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
1. (continued)	• Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
2. Understand the need for continual re-evaluation of knowledge.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
2. (continued)	• Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
3. Discuss the limitations of scientific study.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.		

	Alabama Course of Study: Science		*Alabama High School Graduation Exam*	Stanford 9	Local
3.	(continued)		• Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
4.	Investigate purposes for inquiry in science. - Exploring new phenomena - Verifying previous results - Evaluating predictive nature of a theory or law - Comparing different theories	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
4. (continued)	• Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
5. Analyze uses of hypotheses in scientific investigations. - Evaluating relevance of data - Determining data to be obtained - Interpreting old and new data directly	I-1 Analyze the methods of science used to identify and solve problems. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	
6. Cite examples of the global nature of the scientific enterprise.			
7. Discuss the ethical issues of science. Examples: use of animals and humans in research, use of military technology			
Habits of Science			
8. Exhibit habits necessary for responsible scientific investigation. - Curiosity - Creativity - Imagination - Honesty - Patience - Logical reasoning - Attention to detail - Critical thinking			

Alabama Course of Study: Science		*Alabama High School Graduation Exam*		Stanford 9	Local
9.	Evaluate the reasonableness of an answer to a scientific problem.	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Define and identify examples of hypotheses.		
10.	Use technology for investigation and communication in science.	I-1	Analyze the methods of science used to identify and solve problems. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Skills of Science 11. Use basic scientific process/thinking skills as developmentally appropriate. - Observing - Interpreting - Classifying - Measuring - Communicating - Problem solving	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the science process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science		*Alabama High School Graduation Exam*		Stanford 9	Local
12.	Demonstrate developmentally appropriate applications of higher-order science process/thinking skills. - Recognizing cause and effect - Designing experiments to test ideas - Planning procedures for investigations - Controlling and manipulating variables - Formulating questions leading to further investigations	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the science process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
13. Apply manipulative skills to the scientific process. - Maintenance of accurate records - Correct use of laboratory procedures and techniques - Effective communication or display of results	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
14. Apply appropriate units and significant figures to express measurements and calculated results.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.	X	

Alabama Course of Study: Science		*Alabama High School Graduation Exam*		Stanford 9	Local
15.	Apply mathematical concepts and skills in science and in scientific investigations. - Probability - Graphing skills - Scientific notation - Variable notation - Integers - Fractions, decimals, and percents - Ratio and proportion - Arithmetic mean, mode, and median	I-1	Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
16. Use scientific equipment, apparatus, and technologies safely and efficiently in investigations. Examples: thermometers, microscopes, balances, computers, electronic probe-ware	I-1 Analyze the methods of science used to identify and solve problems. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
17. Use proper procedures in the handling and care of living organisms and specimens derived from living things.			
The Dynamic Earth			
18. Describe locations on maps and globes. - Coordinates determined by latitude and longitude - Polar coordinates			
19. Explain natural phenomena that shape the surface of the Earth. - Rock cycles - Plate motion and interactions - Erosion and deposition - Volcanic activity - Earthquakes			
20. Trace the scientific development of the idea of continental drift and the resulting plate tectonics theory.			
21. Explain how the formation of sedimentary rock serves to produce a record of evolutionary change, both biologic and geologic.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
22. Determine how physical and biological agents and processes affect characteristics of soil. - Fungi - Worms - Plant roots - Physical and chemical weathering - Decomposition			
23. Discuss representative inorganic and organic cycles. Examples: inorganic cycles—water, oxygen, nitrogen Organic cycles—carbon	II-1 Trace the transfer of matter and energy through biological systems. • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
24. Relate weather change and climatic conditions to the heating of atmosphere, oceans, and land masses as well as to the rotation of the Earth.			
25. Determine how natural events impact long-range changes in the surface and climate of the Earth. Examples: volcanic activity, meteorites, El Niño			
26. Explain the factors that determine the feasibility of recycling for some minerals and not for others. - Scarcity - Cost of processing - Cost of reprocessing - Ease of mining/extraction - Trade-offs Example: conservation of energy and natural resources vs. cost of reprocessing			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Matter			
27. Explain the general concept of atoms.	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Determine the number of protons, neutrons, electrons, and mass of an element using the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.	X	
28. Describe major ideas of natural philosophers and scientists in the historical development of concepts about atoms/elements. - Democritus - Empedocles - Dalton - Thomson - Rutherford - Bohr			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
29. Describe particle motion in solids, liquids, and gases.	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
30. Relate the law of conservation of matter to the atomic theory.			
31. Differentiate between homogeneous mixtures (solutions) and heterogeneous mixtures.			
32. Relate the density of a substance to its mass and its volume.	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
33. Explain the organizers of the periodic table. - Atomic number - Groups - Periods	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Determine the number of protons, neutrons, electrons, and mass of an element using the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Energy			
34. Explain the law of the conservation of energy and its relation to energy transformation.	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conversation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.	X	
35. Describe methods of heat transfer. - Conduction - Radiation - Convection			

	Alabama Course of Study: Science		*Alabama High School Graduation Exam*	Stanford 9	Local
36.	Describe the physical effects of heat, chemical, and mechanical energies on matter.	II-2 II-4	Relate particle motion to the state of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter. Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
37. Relate waves to the transfer of energy. - Earthquake waves - Sound waves - Water waves	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.	X	
38. Differentiate among reflection, refraction, and diffraction of water, light, and sound waves.	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media.		
39. Explain the physical interactions of light and matter and their effect on color perception. - Reflection - Absorption - Scattering	VII-2 Relate waves to the transfer of energy. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
40. Discuss the uses of sound, light, radio, and microwave energy to transfer information.	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.		
41. Evaluate factors in producing, harnessing, distributing, and conserving renewable energy sources.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
42. Describe processes by which matter and energy flow through an ecosystem. Examples: photosynthesis, cell respiration, food chain, energy pyramid, life cycle	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration. VII-1 Relate the Law of Conservation of Energy to energy transformation. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
42. (continued)	- Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. - Apply the concept of conversation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
Diversity			
43. Relate the current diversity of life to the total diversity through the ages.	III-1 Distinguish among the taxonomic groups by major characteristics. - Recognize the correct sequence of taxonomic classification of organisms from the most inclusive level to the least inclusive level—may include use of a chart to compare two species and to identify the classification level at which one species no longer shares common characteristics with other species.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
43. (continued)	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction. • Identify reproductive structures and their function in angiosperms. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
43. (continued)	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
44. Recognize the need for organized classification systems in the study of plant and animal life.	III-1 Distinguish among the taxonomic groups by major characteristics. • Recognize the correct sequence of taxonomic classification of organisms from the most inclusive level to the least inclusive level—may include use of a chart to compare two species and to identify the classification level at which one species no longer shares common characteristics with other species.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
44. (continued)	• Classify organisms into the five kingdom based on recognizing two or more characteristics associated with organisms in a given kingdom. • Recognize properly written scientific names using binomial nomenclature.		
45. Explain the effects of environmental changes on dynamic equilibrium in physical and biological systems.	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resources and predict outcomes of that competition.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
45. (continued)	• Identify and define biotic and abiotic components of difference environments. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival.		
46. Describe factors that determine species. - Reproductive viability - Physical characteristics - Genetic code			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Cells 47. Relate types of cells to their specialized structure and function. Examples: nerve cells, muscle cells	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Define and identify representations of diffusion and osmotic systems and what substances are transported by these processes—may include graphic representations. • Recognize differences between active and passive transport of substance and the energy requirements associated with these transport systems. • Identify and define similarities and differences between plant and animal cells. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells.		

	Alabama Course of Study: Science		*Alabama High School Graduation Exam*	Stanford 9	Local
47.	(continued)		• Describe cell locomotion by means of cilia and flagella and recognize some organisms that depend on one or the other means of locomotion. • Identify cell organelles and define functions of cell organelles—may include graphic representations. • Distinguish and identify examples of cellular organization at the cell, tissue, organ, system, and organism level.		
48.	Relate needs to structures within cells of organisms. - Energy capture and release - Transport of materials - Information feedback - Waste disposal - Reproduction - Movement	V-1	Distinguish relationships among cell structures, functions, and organization in living organisms. • Define and identify representations of diffusion and osmotic systems and what substances are transported by these processes—may include graphic representations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
48. (continued)	• Recognize differences between active and passive transport of substance and the energy requirements associated with these transport systems. • Identify and define similarities and differences between plant and animal cells. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells. • Describe cell locomotion by means of cilia and flagella and recognize some organisms that depend on one or the other means of locomotion. • Identify cell organelles and define functions of cell organelles—may include graphic representations. • Distinguish and identify examples of cellular organization at the cell, tissue, organ, system, and organism level.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
49. Describe the processes within the digestive and circulatory systems necessary to prepare and transport food to the cells.			
50. Relate cells, tissues, organs, and systems to each other.	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Define and identify representations of diffusion and osmotic systems and what substances are transported by these processes—may include graphic representations. • Recognize differences between active and passive transport of substance and the energy requirements associated with these transport systems. • Identify and define similarities and differences between plan and animal cells.	X	

	Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
50.	(continued)	• Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells. • Describe cell locomotion by means of cilia and flagella and recognize some organisms that depend on one or the other means of locomotion. • • Identify cell organelles and define functions of cell organelles—may include graphic representations. • Distinguish and identify examples of cellular organization at the cell, tissue, organ, system, and organism level.		
51.	Describe the human reproductive system and life cycle.			

Alabama Course of Study: Science		*Alabama High School Graduation Exam*		Stanford 9	Local
52.	Explain the major changes in human embryonic development occurring in each trimester.	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resources and predict outcomes of that competition. • Identify and define biotic and abiotic components of difference environments. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationship—such as predator/prey—that affect population dynamics and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Interdependence 53. Explain the limited capacity of the atmosphere, oceans, and soil to absorb or recycle materials naturally.	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of difference environments. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
54. Describe the effects of point and non-point sources of pollution on watersheds, river systems, and oceans. Examples: sewage pipe into a stream—point source, agricultural run-off—non-point source	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resources and predict outcomes of that competition. • Identify and define biotic and abiotic components of difference environments. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.	X	

	Alabama Course of Study: Science		*Alabama High School Graduation Exam*	Stanford 9	Local
54.	(continued)		• Explain why diversity within a species is important and how heritable traits ensure survival.		
55.	Explain different relationships among living organisms. - Competition - Symbiosis • Mutualism • Commensalism • Parasitism - Producer/Consumer/Decomposer - Predator/Prey	VI-1	Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resources and predict outcomes of that competition. • Identify and define biotic and abiotic components of difference environments. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
55. (continued)	• Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator-prey—that affect population dynamics and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival. II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
55. (continued)	• Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.		
Careers and Other Fields of Study			
56. Apply scientific knowledge and processes from one domain of science (Earth and Space, Physical, Life) to another and to other fields of study.	II-1 Trace the transfer of matter and energy through biological systems. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. II-4 Identify how factors affect rates of physical and chemical changes.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
56. (continued)	• Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes. VIII-2 Relate force to pressure in fluids. • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		
57. Recognize the importance of science to many careers.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Science, Technology, and Society 58. Place scientific discoveries in historical, social, economical, and ethical perspective.	III-2 Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests. IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
58. (continued)	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. VII-1 Relate the Law of Conservation of Energy to energy transformations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
58. (continued)	• Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
59. Discuss the impact of technology on science, human history, and/or society.	III-2 Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests. IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
59. (continued)	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. VII-1 Relate the Law of Conservation of Energy to energy transformations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
59. (continued)	• Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
60. Discuss the limits of technology in fulfilling human needs.			
61. Analyze the constraints on design of technology. - Physical - Ethical - Aesthetic - Societal - Economic	IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
61. (continued)	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Describe the relationship among DNA, genes, and chromosomes. • Describe in basic terms the structure and functions of DNA. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
62. Explain the importance of testing technology and products of technology in a controlled setting before submission to the general public.	IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.		
	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Describe the relationship among DNA, genes, and chromosomes. • Describe in basic terms the structure and functions of DNA. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
62. (continued)	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		
63. Serve the community through a science-related project. Examples: school-wide recycling, tree planting			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
CONTENT STANDARDS Students will **Nature of Science**			
1. Explain the need for peer review of scientific investigations.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
1. (continued)	• Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
2. Understand the need for continual re-evaluation of knowledge.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
2. (continued)	• Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
3. Discuss the limitations of scientific study.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
3. (continued)	• Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
4. Investigate purposes for inquiry in science. - Exploring new phenomena - Verifying previous results - Evaluating predictive nature of a theory or law - Comparing different theories	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
4. (continued)	• Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
5. Analyze uses of hypotheses in scientific investigations. - Evaluating relevance of data - Determining data to be obtained - Interpreting old and new data directly	I-1 Analyze the methods of science used to identify and solve problems. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	
6. Cite examples of the global nature of the scientific enterprise.			
7. Discuss the ethical issues of science. Examples: use of animals and humans in research, use of military technology			
Habits of Science			
8. Exhibit habits necessary for responsible scientific investigation. - Curiosity - Creativity - Imagination - Honesty - Patience - Logical reasoning - Attention to detail - Critical thinking			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
9. Evaluate the reasonableness of an answer to a scientific problem.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Define and identify examples of hypotheses.		
10. Use technology for investigation and communication in science.	I-1 Analyze the methods of science used to identify and solve problems. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Skills of Science			
11. Use basic scientific process/thinking skills as developmentally appropriate. - Observing - Interpreting - Classifying - Measuring - Communicating - Problem solving	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the science process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
12. Demonstrate developmentally appropriate applications of higher-order science process/thinking skills. - Recognizing cause and effect - Designing experiments to test ideas - Planning procedures for investigations - Controlling and manipulating variables - Making inferences from data and graphs - Formulating questions leading to further investigations - Following the logic of "if…then" statements - Interpreting some formulas as scientific laws	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the science process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
13. Apply manipulative skills to the scientific process. - Maintenance of accurate records - Correct use of laboratory procedures and techniques - Effective communication or display of results	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
14. Apply appropriate units and significant figures to express measurements and calculated results.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
15. Apply mathematical concepts and skills in science and in scientific investigations. - Probability - Graphing skills - Scientific notation - Variable notation - Integers - Fractions, decimals, and percents - Ratio and proportion - Arithmetic mean, mode, and median	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
16. Use scientific equipment, apparatus, and technologies safely and efficiently in investigations. Examples: thermometers, microscopes, balances, computers, electronic probe-ware	I-1 Analyze the methods of science used to identify and solve problems. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
17. Use proper procedures in the handling and care of living organisms and specimens derived from living things.			
The Universe			
18. Describe scientific evidence for the origin and evolution of the Universe.	I-1 Analyze the methods of science used to identify and solve problems. VII-2 Relate waves to the transfer of energy. • Describe how waves travel through different kinds of media. VIII-1 Relate Newton's three laws of motion to real world applications.		
19. Recognize the role of gravity in forming and maintaining planets, stars, and the solar system.			
20. Identify tools and their uses in obtaining information about the Universe. Examples: telescope, spectroscope, computer simulations, star finders			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
21. Describe the components of the Universe and their apparent relationships. - Components: galaxies, starts, planets, moons, asteroids, comets, meteroids, space dust - Relationships: membership in systems, effects on each other, relative, size, distance, motion	VIII-1 Relate Newton's three laws of motion to real world applications.		
22. Explain origins and differences in the physical characteristics of meteors and comets.	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.		
23. Compare masses within the solar system as to composition, size, and orbital motion. - Sun - Planets - Satellites - Debris	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter. VIII-1 Relate Newton's three laws of motion to real world applications.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
23. (continued)	VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)		
24. Apply scale to models of the solar system.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.		
25. Discuss discovery of the speed of light and its application to the measure of distance in the Universe.	VII-2 Relate waves to the transfer of energy. • Describe how waves travel through different kinds of media.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Matter			
26. Explain and use information from solubility curves.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation.	X	
27. Develop an understanding of the relationship between the organization and the predictive nature of the periodic table. - Number of protons and electrons in an atom of an element - Kind of element - Reactivity of some elements - Electron configuration of some elements - Mass of an element	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Determine the number of protons, neutrons, electrons, and mass of an element using the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
27. (continued)	• Use data about the number of electrons in the outer electron shell or an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.		
28. Classify types of elements using atomic electron configuration. - Metals - Nonmetals - Metalloids - Noble gases	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
29. Analyze the properties of different types of matter in relationship to specific intended uses. Examples: properties of gold in jewelry, tungsten in light bulb filaments, viscosity of petroleum components	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such tings as temperature, surface area, and catalysts—including enzymes.		
30. Compare the roles of electrons in covalent, ionic, and metallic bonding.	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
31. Describe chemical reactions as word equations.			
32. Observe factors that affect rates of reaction. - Temperature - Nature of reactants - Catalysts - Surface area	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes.	X	
33. Identify acids, bases, and salts.			
34. Relate chemical concepts derived from several important experiments that resulted in the designation of Antoine Lavoisier as the "father of modern chemistry." - Conservation of matter - Burning as oxidation			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Force and Motion			
35. Apply Newton's laws of motion to the way the world works. - Inertia - Acceleration - Gravitation - Action/Reaction	VIII-1 Relate Newton's three laws of motion to real world applications.	X	
36. Relate change of speed or direction to unbalanced forces acting on an object.	VIII-1 Relate Newton's three laws of motion to real world applications.		
37. Relate force to pressure in fluids.	VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.	X	
38. Relate friction to motion of solids and fluids.	VIII-1 Relate Newton's three laws of motion to real world applications.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
39. Relate variables to the speed of sound waves. - Wavelength - Frequency - Density (of medium) - State (of medium)	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.	X	
Diversity			
40. Recognize the impact of selective breeding, natural selection, genetic defects, and environmental adaptations on the development and survival of species.	III-3 Differentiate structure, functions, and characteristics of animals. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc. IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
40. (continued)	• Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur. IV-2 Explain how the DAN molecule transfers genetic information from parent to offspring. • Describe the relationships among DNA, genes, and chromosomes. • Describe in basic terms the structure and function of DNA. • Define the genetic purpose for meiosis from generation to generation. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
40. (continued)	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and econsystems. • Identify species that are competing for resources and predict outcomes of that competition. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival.		
41. Evaluate fossil evidence for change in organisms over time.	III-2 Differentiate structures, functions, and characteristics of plants.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
41. (continued)	• Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction. • Identify reproductive structures and their function in angiosperms. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests. III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
42. Analyze the development of Charles Darwin's theory of evolution.	III-2 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction. • Identify reproductive structures and their function in angiosperms. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests. III-3 Differentiate structures, functions, and characteristics of animals.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
42. (continued)	• Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.		
Heredity			
43. Investigate lineage of organisms for traits and features. Examples: family genealogy, bloodline of registered pet	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
43. (continued)	• Recognize and evaluate the harms and benefits that result when mutations occur.		
44. Describe the role of DNA in the transmission of traits and characteristics in organisms.	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Describe the relationship among DNA, genes, and chromosomes. • Describe in basic terms the structure and function of DNA. • Define the genetic purpose for meiosis from generation to generation. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
45. Describe the role of probability in the study of heredity.	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.	X	
46. Relate selective breeding to the experiments of Gregor Mendel.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
47. Discuss major factors affecting human health. - Genetics - Behavior - Environment	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.	X	
Cells			
48. Relate microorganisms that invade the human body to common diseases. Examples: viruses, bacteria, fungi			
49. Describe how simple components of the immune system attack blood-borne pathogens and foreign materials in the human body. - White blood cells - Antibodies			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
50. Identify natural substances produced by the human body and the alternate sources from which they are obtained today. Examples: hormones, amino acids, enzymes.			
51. Compare the complexity of circulatory and nervous systems in earthworms, frogs, and humans.	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Interdependence			
52. Predict the potential impact of human activities on long-range changes in the surface and climate of the Earth. - Negative impact Examples: deforestation, ozone depletion - Positive impact Examples: management and conservation of the Earth's wildlife and natural resources	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.	X	
	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
53. Identify limiting factors that impact plant and animal populations.	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify species that are competing for resources and predict outcomes of that competition. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.	X	
54. Relate good health to the monitoring of soil, air, and water for dangerous levels of harmful substances.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Career and Other Fields of Study			
55. Apply scientific knowledge and processes from one domain of science (Earth and Space, Physical, Life) to another and to other fields of study.	II-1 Trace the transfer of matter and energy through biological systems. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes.	X	
	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
55. (continued)	VIII-2 Relate force to pressure in fluids. • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		
56. Recognize the importance of science to many careers.			
Science, Technology, and Society			
57. Place scientific discoveries in historical, social, economical, and ethical perspective.			
58. Discuss the impact of technology on science, human history, and/or society.	III-2 Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
58. (continued)	IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
58. (continued)	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of population and ecosystems. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
59. Discuss the limits of technology in fulfilling human heeds.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
60. Analyze the constraints on design of technology. - Physical - Ethical - Aesthetic - Societal - Economic	IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur. IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Describe the relationship among DNA, genes, and chromosomes. • Describe in basic terms the structure and functions of DNA.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
60. (continued)	• Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.		
	VI-1 Demonstrate and understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		
61. Explain the importance of testing technology and products of technology in a controlled setting before submission to the general public.	IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
61. (continued)	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Describe the relationship among DNA, genes, and chromosomes. • Describe in basic terms the structure and functions of DNA. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring. VI-1 Demonstrate and understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.		
62. Serve the community through a science-related project. Examples: school-wide recycling, tree planting			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
CONTENT STANDARDS Students will **Nature of Science**			
1. Understand fundamental assumptions about the Universe upon which the scientific enterprise is based. - A concern with natural phenomena - Discoverable and understandable operation of the Universe - Connection of natural effects and natural causes - A unified system operating with the same materials and under the same rules - A consistency in nature that assures regularity and, in many cases, predictability in natural phenomena		X	
2. Discuss science as a body of knowledge and an investigative process. - A unified, open-ended structure composed of observations set in a testable framework of ideas (constantly being adjusted and augmented based on empirical evidence) - Limited scope and certainty	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
2. (continued) - Science disciplines sharing a common purpose and philosophy as part of the same scientific enterprise - A context for mathematics and a foundation for technology - Aims that include simplest solutions, most comprehensive results, clearest and most reliable explanations, and most accurate predictions - Pure science developed for its intrinsic worth			
3. Conduct scientific investigations systematically. - Using appropriate resources and technologies for research - Framing the question - Identifying and appropriately managing the variables - Maintaining clear and accurate records - Choosing, constructing, and/or assembling and safely using appropriate equipment and materials - Developing a practical and logical procedure - Organizing, analyzing, and interpreting data - Developing conclusions based on the investigation	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
3. (continued) - Utilizing graphs, tables, charts, and models in oral and written presentations - Knowing and applying safe laboratory practices and accident procedures	• Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
Habits of Science			
4. Exhibit attitudes and habits appropriate to the scientific enterprise. - Curiosity - Creativity - Honesty - Patience - Imagination - Logical reasoning - Attention to detail - Openness to new ideas - Skepticism - Intuition	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
4. (continued)	• Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
Skills of Science			
5. Demonstrate the correct care and safe use of instruments, equipment, materials, and living organisms.	I-1 Analyze the methods of science used to identify and solve problems. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
5. (continued)	• Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
6. Demonstrate the ability to choose, construct, and/or assemble appropriate equipment for scientific investigations.	I-1 Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
7. Apply basic science process/thinking skills. - Observing - Classifying - Measuring - Communicating - Inferring - Predicting	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
8. Apply integrated science process/thinking skills. - Solving problems - Using space-time relationships - Interpreting data - Recognizing cause and effect - Planning the control of variables - Defining procedures - Formulating hypotheses - Designing experiments - Developing models	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
9. Apply appropriate units and significant figures in measurements and calculations.	I-1 Analyze the methods of science used to identify and solve problems. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
10. Use mathematical, simple statistical, and graphical models to express patterns and relationships determined from sets of scientific data.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
11. Solve for unknown quantities in a variety of science-related situations by combining symbolic statements. - Manipulating variables simultaneously - Simplifying a multi-step mechanism (series of reactions that describe an overall change) - Proving two or more mechanisms identical			
12. Use written and oral communication skills to explain scientific phenomena and concepts in appropriate technical and non-technical language.			
Matter			
13. Relate the macroscopic and microscopic characteristics of the four states of matter. Examples: macroscopic characteristic—hardness, microscopic characteristic—close-packing	II-2 Relate particle motion to the state of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
13. (continued)	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
14. Differentiate between physical and chemical properties.	II-2 Relate particle motion to the state of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter. II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
14. (continued)	II-4 Identify how factors affect rate of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes.		
15. Trace the changing model of the atom.		X	
16. Describe the electron configuration of elements in the periodic table.		X	
17. Relate electron configuration to valence and oxidation number.	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
18. Distinguish between physical and chemical changes.	II-1 Trace the transfer of matter and energy through biological systems. • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration. II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter. II-3 Apply information from the periodic table and make predictions using the organization of the periodic table.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
18. (continued)	• Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions. II-4 Identify how factors affect rate of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes. IV-1 Recognize heritable characteristics of organisms. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
18. (continued)	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Recognize differences between active and passive transport of substances and the energy requirements associated with these transport systems. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
18. (continued)	• Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, eqalization of pressure on the eardrum, and turgor pressure.		
19. Differentiate the effects of heat energy between changes of temperature and states of matter.	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
19. (continued)	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
20. Differentiate between homogeneous and heterogeneous mixtures.	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
20. (continued)	VII-2 Relate waves to the transfer of energy. • Describe how waves travel through different kinds of media.		
21. Compare the roles of electrons in covalent, ionic, and metallic bonding.	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
22. Demonstrate uses of the periodic table. - To determine number of protons, electrons, and neutrons - To identify types of elements - To determine reactivity - To write formulas - To identify types of compounds formed	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Determine the number of protons, neutrons, electrons, and mass of an element using the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.	X	
23. Write simple chemical equations for the four basic types of reactions. - Formula equations - Word equations	II-1 Trace the transfer of matter and energy through biological systems. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
23. (continued)	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions, less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
24. Balance simple chemical equations for the four basic types of reactions.			
25. Describe factors that affect rates of reaction. - Temperature - Concentration - Surface area - Catalysts	II-4 Identify how factors affect rate of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes.	X	
26. Apply calorimetry to investigate heat of reaction.		X	
27. Analyze the properties and interactions of acids, bases, and salts.		X	
28. Explain the formation of saturated and supersaturated solutions.		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
29. Relate certain factors to solubility and rate of solution. - Nature of solute and solvent - Temperature - Agitation - Surface area - Pressure (gases only)	II-1 Trace the transfer of matter and energy through biological systems. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration. II-4 Identify how factors affect rate of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, eqalization of pressure on the eardrum, and turgor pressure.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
30. Explain and use information from solubility curves.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.	X	
31. Analyze water to determine the presence of organic and inorganic materials.		X	
32. Explain similarities and differences in isotopes of an element.	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Determine the number of protons, neutrons, electrons, and mass of an element using the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
32. (continued)	• Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.		
33. Write simple nuclear equations.			
34. Describe the conversion of mass to energy and energy to mass.			
Energy			
35. Describe mathematically the relationships among potential energy, kinetic energy, and work.	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
36. Analyze simple machines, both qualitatively and quantitatively.		X	
37. Explain the trade-offs inherent in the use of machines to do work. Examples: bicycle—increased speed at the expense of force, crowbar—increased force at the expense of distance	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.	X	
38. Illustrate the transfer of energy through waves.	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
39. Relate physical properties of sound and light to wave characteristics. Examples: loudness to amplitude, pitch to frequency, color to wavelength and frequency	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.	X	
40. Differentiate between heat and temperature as they affect molecules.	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter. II-4 Identify how factors affect rates of physical and chemical changes.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
40. (continued)	• Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
41. Explain methods of heat transfer. - Conduction - Radiation - Convection	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter. VII-2 Relate waves to the transfer of energy. • Describe how waves travel through different kinds of media.	X	
42. Solve heat-loss and heat-gain problems.		X	
43. Distinguish between induction and conduction of static charge.			
44. Relate electricity and magnetism through inductance.		X	
45. Apply quantitative relationships among voltage, current, and resistance in series and parallel circuits.		X	
Force and Motion			
46. Differentiate among the four basic natural forces.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
47. Apply quantitative relationships among force, area, and pressure in fluids. Examples: fluid pressure, buoyancy, hydraulics (Pascal's law), Bernoulli and Venturi effects	VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.	X	
48. Apply the quantitative relationships among force, distance, work, time, and power.		X	
49. Determine the resultant, graphically and mathematically, of two vector quantities acting simultaneously on an object.		X	
50. Demonstrate ways that simple machines can change force.		X	
51. Determine if an object is in equilibrium.	VIII-1 Relate Newton's three laws of motion to real world applications.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
52. Explain the significance of the friction force in mechanics.	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.	X	
53. Distinguish between fundamental and derived units. Examples: kilogram, meter, second, Newton, joule, m/s^2			
54. Demonstrate the relationship between force and motion in Newton's laws.	VIII-1 Relate Newton's three laws of motion to real world applications.	X	
55. Apply quantitative relationships among position, displacement, distance, time, speed, velocity, and acceleration.	VIII-1 Relate Newton's three laws of motion to real world applications.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
56. Compare accepted and student experimentally determined values of g (gravitational acceleration).	VIII-1 Relate Newton's three laws of motion to real world applications.		
57. Relate gravitational or centripetal force to projectile or uniform circular motion.	VIII-1 Relate Newton's three laws of motion to real world applications.	X	
58. Apply quantitative relationships among mass, velocity, force, and momentum.	VIII-1 Relate Newton's three laws of motion to real world applications.	X	
59. Describe situations where momentum is and is not conserved.			
60. Analyze the effects of prisms as well as concave/ convex mirrors and lenses on the motion of light.	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Careers and Other Fields of Study			
61. Apply scientific knowledge and processes from one domain of science (Earth and Space, Physical, Life) to another and to other fields of study.	II-1 Trace the transfer of matter and energy through biological systems. • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
61. (continued)	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc. IV-1 Recognize heritable characteristics of organisms. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Describe in basic terms the structure and function of DNA. V-1 Distinguish relationships among cell structures, functions, and organization in living organisms.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
61. (continued)	• Define and identify representations of diffusion and osmotic systems and what substances are transported by these processes—may include graphic representations. • Recognize differences between active and passive transport of substances and the energy requirements associated with these transport systems. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
61. (continued)	• Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids. VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy. VIII-1 Relate Newton's three laws of motion to real world applications. VIII-2 Relate force to pressure in fluids.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
61. (continued)	• Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		
62. Recognize the importance of science and technology to many careers.		X	
Science, Technology, and Society			
63. Discuss the mutual influences of science, technology, and society.	III-2 Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests. IV-1 Recognize heritable characteristics or organisms.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
63. (continued)	• Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		

596

597

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
64. Identify trade-offs that individuals and society must consider when making decisions concerning the use or conservation of resources.	VI-1 Demonstrate and understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
65. Discuss factors that serve as potential constraints on technological design and use. - Ethics - Ecology - Manufacturing process - Operation - Maintenance - Replacement - Disposal - Liability	VI-1 Demonstrate and understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
66. Serve the community through a science-related project. Examples: recycling at school, monitoring air and water quality, evaluating waste-management issues			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
CONTENT STANDARDS Students will **Nature of Science**			
1. Understand fundamental assumptions about the Universe upon which the scientific enterprise is based. - A concern with natural phenomena - Discoverable and understandable operation of the Universe - Connection of natural effects and natural causes - A unified system operating with the same materials and under the same rules - A consistency in nature that assures regularity and, in many cases, predictability in natural phenomena			
2. Discuss science as a body of knowledge and an investigative process. - A unified, open-ended structure composed of observations set in a testable framework of ideas (constantly being adjusted and augmented based on empirical evidence) - Limited scope and certainty	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
2. (continued) - Science disciplines sharing a common purpose and philosophy as part of the same scientific enterprise - A context for mathematics and a foundation for technology - Aims that include simplest solutions, most comprehensive results, clearest and most reliable explanations, and most accurate predictions - Pure science developed for its intrinsic worth			
3. Conduct scientific investigations systematically. - Using appropriate resources and technologies for research - Framing the question - Identifying and appropriately managing the variables - Maintaining clear and accurate records - Choosing, constructing, and/or assembling and safely using appropriate equipment and materials - Developing a practical and logical procedure - Organizing, analyzing, and interpreting data - Developing conclusions based on the investigation	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
3. (continued) - Utilizing graphs, tables, charts, and models in oral and written presentations - Knowing and applying safe laboratory practices and accident procedures	• Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
Habits of Science			
4. Exhibit attitudes and habits appropriate to the scientific enterprise. - Curiosity - Imagination - Creativity - Honesty - Patience - Logical reasoning - Attention to detail - Critical thinking - Openness to new ideas - Skepticism	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
4. (continued)	• Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
Skills of Science			
5. Demonstrate the correct care and safe use of instruments, equipment, materials, and living organisms.	I-1 Analyze the methods of science used to identify and solve problems. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
6. Demonstrate the ability to choose, construct, and/or assemble appropriate equipment for scientific investigations.	I-1 Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
7. Apply basic science process/thinking skills. - Observing - Classifying - Measuring - Communicating - Predicting - Inferring	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
8. Apply integrated science process/thinking skills. - Solving problems - Using space-time relationships - Interpreting data - Recognizing cause and effect - Planning the control of variables - Defining procedures - Formulating hypotheses - Designing experiments - Developing models	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
9. Apply appropriate units and significant figures in measurements and calculations.	I-1 Analyze the methods of science used to identify and solve problems. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
10. Use mathematical, simple statistical, and graphical models to express patterns and relationships determined from sets of scientific data.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
11. Solve for unknown quantities in a variety of science-related situations by combining symbolic statements. - Manipulating variables simultaneously - Simplifying a multi-step mechanism (series of reactions that describe an overall change) - Proving two or more mechanisms identical			
12. Use written and oral communication skills to explain scientific phenomena and concepts in appropriate technical and non-technical language.			
Matter			
13. Relate conservation of matter and energy to the flow of energy through food webs.	II-2 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
13. (continued)	• Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration. VII-1 Relate the Law of Conservation of Energy to energy transformation. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
14. Describe the use of isotopic dating in determining the age of fossils.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Diversity			
15. Discuss the relationships among organisms as the basis for the biological system of classification.	III-1 Distinguish among the taxonomic groups by major characteristics. • Recognize the correct sequence of taxonomic classification of organisms from the most inclusive level to the least inclusive level—may include use of a chart to compare two species and to identify the classification level at which one species no longer shares common characteristics with other species. • Classify organisms into the five kingdoms based on recognizing two or more characteristics associated with organisms in a given kingdom. • Recognize properly written scientific names using binomial nomenclature.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
16. Illustrate taxonomic groupings (the five kingdoms) and major characteristics of each kingdom.	III-1 Distinguish among the taxonomic groups by major characteristics. • Recognize the correct sequence of taxonomic classification of organisms from the most inclusive level to the least inclusive level—may include use of a chart to compare two species and to identify the classification level at which one species no longer shares common characteristics with other species. • Classify organisms into the five kingdoms based on recognizing two or more characteristics associated with organisms in a given kingdom. • Recognize properly written scientific names using binomial nomenclature.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
17. Describe structure, characteristics, and lytic cycle of viruses.	IV-1 Recognize heritable characteristics of organisms. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur. IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Describe in basic terms the structure and function of DNA.	X	
18. Differentiate structures, characteristics, and life cycles of monerans, protists, and fungi.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
19. Compare representative plants by structure and function. Examples: moss, ferns, gymnosperms, angiosperms	III-3 Differentiate structures, functions, and characteristics of plants. • Identify various plants as being vascular or nonvascular and describe the basic mechanisms by which vascular and nonvascular plants sustain themselves. • Identify the distinguishing characteristics of angiosperms and gymnosperms in terms of their structures and reproduction. • Identify reproductive structures and their function in angiosperms. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.	X	
20. Compare the complexity of major anatomical structures in sponges, worms, echinoderms, arthropods, and vertebrates.		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
21. Evaluate the theory of natural selection. - Survival in particular environments - Fossil and genetic records - Climatic events	III-3 Differentiate structures, functions, and characteristics of animals. • Differentiate characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc. IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
21. (continued)	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resources and predict outcomes of that competition. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
22. Describe how natural selection affects populations as compared to individuals.			
23. Examine factors that affect populations. - Migration - Distribution - Competition for limited resources - Disease - Natural disasters	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resources and predict outcomes of that competition. • Identify and define biotic and abiotic components of different environments. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
23. (continued)	• Explain why diversity within a species is important and how heritable traits ensure survival.		
24. Explain the importance of diversity within and among species.	III-2 Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests. III-3 Differentiate structures, functions, and characteristics of animals. • Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
24. (continued)	• Explain why diversity within a species is important and how heritable traits ensure survival.		
Heredity			
25. Identify species by comparing similarities in molecular and anatomical evidence.	III-1 Distinguish among the taxonomic groups by major characteristics. • Recognize the correct sequence of taxonomic classification of organisms from the most inclusive level to the least inclusive level—may include use of a chart to compare two species and to identify the classification level at which one species no longer shares common characteristics with other species. • Classify organisms into the five kingdoms based on recognizing two or more characteristics associated with organisms in a given kingdom.		

640

641

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
25. (continued)	III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits.		
26. Recognize heritable characteristics of organisms. - Physical structure - Chemical composition - Behavior	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
27. Explain the transfer of information from parents to offspring through genes within DNA molecules.	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Describe the relationships among DNA, genes, and chromosomes. • Describe in basic terms the structure and function of DNA. • Define the genetic purpose for meiosis from generation to generation. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.	X	
28. Determine all possible combinations of offspring produced by the sorting and recombining of genes in sexual reproduction.	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
28. (continued)	• Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.		
29. Identify the genetics in common inheritance-linked diseases and deformities.	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
30. Analyze factors in the production of genetic mutations in an organism and/or its offspring. - Radiation - Chemicals - Chance	IV-1 Recognize heritable characteristics of organisms. • Identify physical traits that are passed from parents to offspring. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. • Recognize and evaluate the harms and benefits that result when mutations occur.		
31. Describe the impact of genetics, genetic engineering, selective breeding, and cloning on ethical issues associated with each.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Cells			
32. Analyze relationships among cell structure, function, and organization in plants and animals.	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Define and identify representations of diffusion and osmotic systems and what substances are transported by these processes—may include graphic representations. • Recognize differences between active and passive transport of substances and the energy requirements associated with these transport systems. • Identify and define similarities and differences between plan and animal cells. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
32. (continued)	• Describe cell locomotion by means of cilia and flagella and recognize some organisms that depend on one or the other of these means of locomotion. • Identify cell organelles and define functions of cell organelles—may include graphic representations. • Distinguish and identify examples of cellular organization at the cell, tissue, organ, system, and organism level.		
33. Analyze the process by which cells become specialized even though DNA is identical in every cell within an organism.	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Define and identify representations of diffusion and osmotic systems and what substances are transported by these processes—may include graphic representations.		
34. Relate cellular functions to specialized structures within cells. - Transport of materials - Energy capture and release - Protein synthesis - Waste disposal - Information feedback - Movement		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
34. (continued)	• Recognize differences between active and passive transport of substances and the energy requirements associated with these transport systems. • Identify and define similarities and differences between plan and animal cells. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells. • Describe cell locomotion by means of cilia and flagella and recognize some organisms that depend on one or the other of these means of locomotion. • Identify cell organelles and define functions of cell organelles—may include graphic representations. • Distinguish and identify examples of cellular organization at the cell, tissue, organ, system, and organism level.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
35. Analyze factors that can affect cellular activities. - Molecular factors Examples: carbohydrates, lipids, proteins, nucleic acids - Environmental factors Examples: acidity, temperature extremes, light	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes.		
36. Differentiate between the stages of mitosis and meiosis.	V-2 Differentiate between mitosis and meiosis. • Define, contrast, and compare mitosis and meiosis—may include events needed to prepare the cell for these processes. • Describe the purpose of mitotic and meiotic divisions during different life stages of organisms—such as asexual and sexual reproduction and growth and repair.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
37. Describe coordination of the structures and functions of different tissues within organs, organs within systems, and systems with one another to accomplish a common purpose.	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Define and identify representations of diffusion and osmotic systems and what substances are transported by these processes—may include graphic representations. • Recognize differences between active and passive transport of substances and the energy requirements associated with these transport systems. • Identify and define similarities and differences between plan and animal cells. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells. • Describe cell locomotion by means of cilia and flagella and recognize some organisms that depend on one or the other of these means of locomotion.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
37. (continued)	- Identify cell organelles and define functions of cell organelles—may include graphic representations. - Distinguish and identify examples of cellular organization at the cell, tissue, organ, system, and organism level.		
Interdependence			
38. Describe factors, both biotic and abiotic, that affect the ability of the environment to support life.	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of ecosystems. - Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. - Identify species that are competing for resources and predict outcomes of that competition. - Identify and define biotic and abiotic components of different environments.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
38. (continued)	• Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		
39. Discuss factors that might affect the dynamic equilibrium of ecosystems. - Disasters Examples: fire, flood - Climate changes - Introduction of new species - Human activities	V-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
39. (continued)	• Identify species that are competing for resources and predict outcomes of that competition. • Identify and define biotic and abiotic components of different environments. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
40. Describe the phases or events by which a damaged ecosystem may attempt to correct itself.	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems.		
41. Describe possible environmental checks (limiting factors) to overpopulation of certain organisms. - Depletion of food/water/nesting sites - Increased number and/or kinds of predators - Increased number of parasites and/or disease	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
41. (continued)	• Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify species that are competing for resources and predict outcomes of that competition. • Identify and define biotic and abiotic components of different environments. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. • Explain why diversity within a species is important and how heritable traits ensure survival.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
42. Describe biomes. Examples: salt and fresh water, salt marsh, pine barrens, deciduous forest, urban ecosystems in Alabama	III-2 Distinguish among the taxonomic groups by major characteristics. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests.		
Careers and Other Fields of Study			
43. Apply biological knowledge and processes to other science disciplines and to other fields of study.			
44. Relate the use of modern biological techniques, materials, and analytical methods to careers and real-world applications.			
Science, Technology, and Society			
45. Discuss the mutual influences of science, technology, and society.	III-2 Differentiate structures, functions, and characteristics of plants.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
45. (continued)	• Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests. IV-1 Recognize heritable characteristics of organisms. • Recognize how genetic traits including diseases and disorders are passed from one generation to the next—may include family pedigrees and monohybrid Punnett squares. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
45. (continued)	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Determine how viruses, bacteria, and parasites affect the dynamic equilibrium of populations. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
46. Identify trade-offs that individuals and society must consider when making decisions concerning the use or conservation of resources.	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Describe the harmful/beneficial consequences of introducing a non-native species into an ecosystem. • Identify and define biotic and abiotic components of different environments. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. • Identify factors and relationships—such as predator/prey—that affect population dynamics and ecosystems. VII-1 Relate the Law of Conservation of Energy to energy transformations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
46. (continued)	• Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
47. Discuss factors that serve as potential constraints on technological design and use. - Ethics - Ecology - Manufacturing process - Operation - Maintenance - Replacement - Disposal - Liability	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
47. (continued)	• Apply the concept of conservation and transformations of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
48. Serve the community through a science-related project. Examples: recycling at school, monitoring air and water quality, evaluating waste-management issues			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
CONTENT STANDARDS			
Students will			
Nature of Science			
1. Understand fundamental assumptions about the Universe upon which the scientific enterprise is based. - A concern with natural phenomena - Discoverable and understandable operation of the Universe - Connection of natural effects and natural causes - A unified system operating with the same materials and under the same rules - A consistency in nature that assures regularity and, in many cases, predictability in natural phenomena		X	
2. Discuss science as a body of knowledge and an investigative process. - A unified, open-ended structure composed of observations set in a testable framework of ideas (constantly being adjusted and augmented based on empirical evidence) - Limited scope and certainty	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
2. (continued) - Science disciplines sharing a common purpose and philosophy as part of the same scientific enterprise - A context for mathematics and a foundation for technology - Aims that include simplest solutions, most comprehensive results, clearest and most reliable explanations, and most accurate predictions - Pure science developed for its intrinsic worth			
3. Conduct scientific investigations systematically. - Using appropriate resources and technologies for research - Framing the question - Identifying and appropriately managing the variables - Maintaining clear and accurate records - Choosing, constructing, and/or assembling and safely using appropriate equipment and materials - Developing a practical and logical procedure - Organizing, analyzing, and interpreting data - Developing conclusions based on the investigation	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
3. (continued) - Utilizing graphs, tables, charts, and models in oral and written presentations - Knowing and applying safe laboratory practices and accident procedures	• Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
Habits of Science 4. Exhibit attitudes and habits appropriate to the scientific enterprise. - Curiosity - Creativity - Honesty - Patience - Imagination - Logical reasoning - Attention to detail - Openness to new ideas - Skepticism - Intuition	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
4. (continued)	• Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
Skills of Science			
5. Demonstrate the correct care and safe use of instruments, equipment, materials, and living organisms.	I-1 Analyze the methods of science used to identify and solve problems. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
6. Apply a variety of techniques in laboratory investigations. Examples: microscale, macroscale	I-1 Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
7. Demonstrate the ability to choose, construct, and/or assemble appropriate equipment for scientific investigations.	I-1 Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
8. Apply basic science process/thinking skills. - Observing - Classifying - Measuring - Communicating - Inferring - Predicting	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
8. (continued)	• Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
9. Apply integrated science process/thinking skills. - Solving problems - Using space-time relationships - Interpreting data - Recognizing cause and effect - Planning the control of variables - Defining procedures - Formulating hypotheses - Designing experiments - Developing models	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
10. Apply appropriate units and significant figures in measurements and calculations.		X	
11. Use mathematical, simple statistical, and graphical models to express patterns and relationships determined from sets of scientific data.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts.	X	
12. Solve for unknown quantities in a variety of science-related situations by combining symbolic statements. - Manipulating variables simultaneously - Simplifying a multi-step mechanism (series of reactions that describe an overall change) - Proving two or more mechanisms identical			
13. Use written and oral communication skills to explain scientific phenomena and concepts in appropriate technical and non-technical language.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Matter			
14. Relate the macroscopic and microscopic characteristics of the four states of matter. Examples: macroscopic characteristics—hardness, microscopic characteristics—close-packing	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter. II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
14. (continued)	• Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		
15. Explain characteristics of atoms and any relationships that exist among them. Examples: structure, atomic size, reactivity, bonding	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Determine the number of protons, neutrons, electrons, and mass of an element using the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
16. Compare characteristics of isotopes of the same element. - Nuclear composition - Stability - Physical properties - Chemical properties	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Determine the number of protons, neutrons, electrons, and mass of an element using the periodic table. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.	X	
17. Relate the half-life of radioactive elements to age estimation of appropriate materials.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
18. Predict patterns of change of properties by groups and periods.	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.	X	
19. Relate changes of properties and energy to physical and chemical changes.	II-1 Trace the transfer of matter and energy through biological systems. • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
19. (continued)	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use the periodic table to identify and locate metals, nonmetals, metalloids, and noble gases. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
19. (continued)	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
20. Differentiate among types of chemical reactions in the laboratory.	II-1 Trace the transfer of matter and energy through biological systems. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
20. (continued)	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.		
21. Simulate physical and chemical interactions of atoms, ions, and molecules using balanced equations, physical models, and computer models.		X	
22. Analyze different types of stoichiometric relationships. - Atoms - Molecules - Electrons - Masses - Volumes (gases only)		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
23. Analyze variables and their influence on rates of reaction using the kinetic theory and the collision theory of reaction. - Temperature - Concentration (pressure of gases) - State of division - Catalysts	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		
24. Apply models to describe relationships among variables involved in physical and chemical changes. - Verbal statements - Mathematical statements - Graphs - Tables - Spreadsheets	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
25. Describe the preparation and properties of solutions. - Components - Classifications - Solubility and concentrations - Conductivity - Colligative properties	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
26. Differentiate between acids and bases. - pH and pOH - Weak and strong - Dilute and concentrated		X	
27. Relate certain factors to solubility and rate of solution. - Nature of solute and solvent - Temperature - Agitation - Surface area - Pressure (gases only)	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
28. Explain the ways in which buffers maintain constancy of pH.		X	
29. Apply Le Chatelier's principle to explain a variety of changes in physical and chemical equilibria.	II-1 Trace the transfer of matter and energy through biological systems. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
29. (continued)	• Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		
30. Explain the ability of biogeochemical cycles to lessen some environmental problems.	II-1 Trace the transfer of matter and energy through biological systems. • Identify, define, and distinguish among producers (autotrophs), consumers, and decomposers (heterotrophs). • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
30. (continued)	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
31. Use models to make predictions about chemical bonds, chemical reactivity, and polarity of molecules.	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.	X	
Energy			
32. Differentiate the effects of heat energy in changes of temperature and states of matter.	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
32. (continued)	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.	X	
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat-can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
33. Explain the relationship of energy, stability, and disorder (entropy) to chemical spontaneity.		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
34. Describe uses of bright line, absorption, and band spectra. - Explaining quantized electron energy levels - Analyzing spectra qualitatively and quantitatively - Explaining molecular structure - Illustrating red shift	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Determine the number of protons, neutrons, electrons, and mass of an element using the periodic table. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
34. (continued)	• Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
35. Apply different ranges of the electromagnetic spectrum for specific purposes.	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
35. (continued)	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
36. Analyze physical and chemical processes involving atoms, molecules, and ions that result in endothermic and exothermic changes.	II-1 Trace the transfer of matter and energy through biological systems. • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
36. (continued)	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter. II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
36. (continued)	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
36. (continued)	• Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)		
37. Distinguish between chemical and nuclear changes.	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Determine the number of protons, neutrons, electrons, and mass of an element using the periodic table. • Use data about the number of electrons in the outer electron shell of an atom, including simple dot diagrams, to determine its stability/reactivity and be able to predict ionic charge resulting from reactions.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
37. (continued)	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.	X	
	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Careers and Other Fields of Study			
38. Apply chemical knowledge and processes to other science disciplines and to other fields of study.	II-1 Trace the transfer of matter and energy through biological systems. • Trace the flow of energy through food chains, food webs, and energy pyramids. • Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration.	X	
	II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems-such as the digestive process. Note: Factors and substances include such things as temperature, concentration, surface area, and catalysts—including enzymes.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
38. (continued)	IV-1 Recognize heritable characteristics of organisms. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations.	X	
	IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Describe in basic terms the structure and function of DNA.		
	V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Define and identify representations of diffusion and osmotic systems and what substances are transported by these processes—may include graphic representations. • Recognize differences between active and passive transport of substances and the energy requirements associated with these transport systems.		
	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of ecosystems. • Identify and define biotic and abiotic components of different environments.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
38. (continued)	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
39. Relate the use of modern chemical techniques, materials, and analytical methods to careers and real-world applications.		X	
Science, Technology, and Society			
40. Discuss the mutual influences of science, technology, and society.	IV-1 Recognize heritable characteristics of organisms. • Identify what happens to the DNA code when a mutation occurs and identify the major causes of mutations. IV-2 Explain how the DNA molecule transfers genetic information from parent to offspring. • Define and distinguish between dominant and recessive genes and how each is expressed in parents and offspring. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
40. (continued)	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
41. Identify trade-offs that individuals and society must consider when making decisions concerning the use or conservation of resources.	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.	X	
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
41. (continued)	• Apply the concept of conservation and transformations of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
42. Discuss factors that serve as potential constraints on technological design and use. - Ethics - Ecology - Manufacturing process - Operation - Maintenance - Replacement - Disposal - Liability	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.	X	
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
42. (continued)	- Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
43. Serve the community through a science-related project. Examples: recycling at school, monitoring air and water quality, evaluating waste-management issues			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
CONTENT STANDARDS Students will **Nature of Science**			
1. Understand fundamental assumptions about the Universe upon which the scientific enterprise is based. - A concern with natural phenomena - Discoverable and understandable operation of the Universe - Connection of natural effects and natural causes - A unified system operating with the same materials and under the same rules - A consistency in nature that assures regularity and, in many cases, predictability in natural phenomena		X	
2. Discuss science as a body of knowledge and an investigative process. - A unified, open-ended structure composed of observations set in a testable framework of ideas (constantly being adjusted and augmented based on empirical evidence) - Limited scope and certainty	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
2. (continued) - Science disciplines sharing a common purpose and philosophy as part of the same scientific enterprise - A context for mathematics and a foundation for technology - Aims that include simplest solutions, most comprehensive results, clearest and most reliable explanations, and most accurate predictions - Pure science developed for its intrinsic worth			
3. Conduct scientific investigations systematically. - Using appropriate resources and technologies for research - Framing the question - Identifying and appropriately managing the variables - Maintaining clear and accurate records - Choosing, constructing, and/or assembling and safely using appropriate equipment and materials - Developing a practical and logical procedure - Organizing, analyzing, and interpreting data - Developing conclusions based on the investigation	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
3. (continued) - Utilizing graphs, tables, charts, and models in oral and written presentations - Knowing and applying safe laboratory practices and accident procedures	• Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct investigation.		
Habits of Science			
4. Exhibit attitudes and habits appropriate to the scientific enterprise. - Curiosity - Creativity - Honesty - Patience - Imagination - Logical reasoning - Attention to detail - Critical thinking - Openness to new ideas - Skepticism - Intuition	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process.	X	

753

759

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
4. (continued)	• Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.		
Skills of Science 5. Demonstrate the correct care and safe use of instruments, equipment, materials, and living organisms.	I-1 Analyze the methods of science used to identify and solve problems. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
6. Demonstrate the ability to choose, construct, and/or assemble appropriate equipment for scientific investigations.	I-1 Analyze the methods of science used to identify and solve problems. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
7. Apply basic science process/thinking skills. - Observing - Classifying - Measuring - Communicating - Inferring - Predicting	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
8. Apply integrated science process/thinking skills. - Solving problems - Using space-time relationships - Interpreting data - Recognizing cause and effect - Planning the control of variables - Defining procedures - Formulating hypotheses - Designing experiments - Developing models	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify safe laboratory procedures when handling chemicals, using Bunsen burners, and using laboratory glassware. • Define and identify examples of hypotheses. • Order the proper sequence of steps within the scientific process. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
9. Apply appropriate units and significant figures in measurements and calculations.	I-1 Analyze the methods of science used to identify and solve problems. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass. • Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an investigation.	X	
10. Use mathematical, simple statistical, and graphical models to express patterns and relationships determined from sets of scientific data.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
11. Solve for unknown quantities in a variety of science-related situations by combining symbolic statements. - Manipulating variables simultaneously - Simplifying a multi-step mechanism (series of reactions that describe an overall change) - Proving two or more mechanisms identical			
12. Use written and oral communication skills to explain scientific phenomena and concepts in appropriate technical and non-technical language.			
The Universe			
13. Discuss the reasons (ideas, models, and evidence) for the shift in belief from a geocentric view of the Universe to a heliocentric one.		X	
14. Describe scientific evidence that dates the Universe.		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
15. Describe the physical and nuclear dynamics involved in the formation, evolution, and destruction of a star.	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.	X	
16. Discuss the technology used to scan the Universe for information concerning its origins and composition. Examples: telescopes (visual, x-ray, radio), spectroscopes, space probes, computers, high energy accelerators	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.	X	
17. Describe the origins of heat that keep rock in a semi-fluid state in the interiors of the Earth and other planets.	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
17. (continued)	• Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
	VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)		
Matter			
18. Relate the effects of thermal energy to the kinetic theory.	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
18. (continued)	• Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.		
19. Differentiate among electrical conductors, semiconductors, and superconductors.		X	
20. Construct an energy-level diagram that accounts for some aspects of the emission spectrum of hydrogen.			
21. Describe the deficiencies of the Bohr model that led to the development of the wave-mechanical model of the atom.		X	
22. Describe the composition and properties of the atomic nucleus.	II-3 Apply information from the periodic table and make predictions using the organization of the periodic table. • Determine the number of protons, neutrons, electrons, and mass of an element using the periodic table.	X	
23. Illustrate the availability of energy with a mass-defect diagram and/or calculation.			

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
24. Describe the types and properties of radiation emitted by the nucleus.	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
Energy			
25. Analyze limiting factors affecting energy resources that require development of more efficient technology and conservation.	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.	X	
26. Demonstrate quantitatively the conversion of energy (mechanical, heat, light, electrical) from one form to another.	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
27. Explain the implications of the second law of thermodynamics.			
28. Relate physical properties of sound and light to wave characteristics. Examples: loudness to amplitude, pitch to frequency, color to wavelength and frequency	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.	X	
29. Describe the characteristics of different types of waves in the electromagnetic spectrum.	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
30. Explain the electrical analog to such gravitational phenomena as mass, force, field, potential energy, and potential difference.		X	
31. Apply instrumentation to determine and monitor electrical quantities. - Ohmmeter to measure resistance - Ammeter to measure current - Voltmeter and oscilloscope to measure potential difference			
32. Apply quantitative relationships among charge, current, potential energy, potential difference, resistance, and electrical power for simple series, parallel, or combination DC circuits.		X	
33. Apply the quantitative relationships among mass, weight, potential energy, kinetic energy, work, time, and power.	VIII-1 Relate Newton's three laws of motion to real world applications.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
34. Describe several ways that patterns of sound or light are transformed for communication purposes.	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.	X	
	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.		
35. Use the principle of work-energy to analyze quantitatively situations (translational and rotational) where mechanical energy is conserved and where mechanical energy is not conserved.		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
36. Determine the specific heat of a solid and/or liquid and the heats of fusion and vaporization of liquids using calorimetry.		X	
Force and Motion			
37. Demonstrate the unified field theory and similarity of interactive forces. Examples: gravitational force to mass, electrical force to charged particles, magnetic force to magnetic poles		X	
38. Describe the four basic natural forces.			
39. Explain the origins of intramolecular and intermolecular forces in matter.	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
40. Apply the quantitative relationships between magnetic and electric phenomena to technology.		X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
41. Demonstrate the relationships between and among nuclear forces, mass defect per nucleon, and the energy released by nuclear reactions.	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.	X	
42. Solve vector problems related to force graphically and analytically.	VIII-1 Relate Newton's three laws of motion to real world applications.	X	
43. Apply quantitative relationships among forces, pressures, and areas to hydraulics.	VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.)	X	
44. Calculate the force on a charged particle at rest and/or in motion.	VIII-1 Relate Newton's three laws of motion to real world applications.	X	
45. Demonstrate an understanding of Galileo's analysis and Newton's laws to explain and perform calculations relating to the motion of single objects in real-world situations.	VIII-1 Relate Newton's three laws of motion to real world applications.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
46. Analyze the motion of an object acted on by more than one force.	VIII-1 Relate Newton's three laws of motion to real world applications.	X	
47. Determine if an object is in translational and/or rotational equilibrium.	VIII-1 Relate Newton's three laws of motion to real world applications.	X	
48. Quantify the relationships between force and motion in Newton's laws.	VIII-1 Relate Newton's three laws of motion to real world applications.	X	
49. Interpret graphic data related to constant and accelerated motion over time intervals.	I-1 Analyze the methods of science used to identify and solve problems. • Use process skills to interpret data from graphs, tables, and charts. • Identify and distinguish between controls and variables in a scientific investigation. • Identify and use appropriate Systeme International (SI) units for measuring dimensions, volume, and mass.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
50. Analyze elastic and inelastic collisions.	II-2 Relate particle motion to the states of matter (solids, liquids, and gases). • Identify states of matter in terms of molecular (particle) movement, density, and kinetic energy associated with each phase/state of a given type of matter.	X	
51. Illustrate different physical interactions between light and matter using a particle or wave model. - Diffraction - Refraction - Reflection - Absorption - Photoelectric effect - Line spectra - Interference - Polarization	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
52. Determine the characteristics of images formed by various mirrors and lenses.		X	
53. Trace the path of light through simple optical devices. Examples: slide projector, binoculars, telescope, microscope	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media. • Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy.	X	
54. Determine the wavelength(s) of a light source from diffraction and/or interference data.	VII-2 Relate waves to the transfer of energy. • Relate wavelength to energy. • Describe how waves travel through different kinds of media.	X	
Career and Other Fields of Study			
55. • Apply physical knowledge and processes to other science disciplines and to other fields of study.	II-1 Trace the transfer of matter and energy through biological systems. • Trace the flow of energy through food chains, food webs, and energy pyramids.	X	

796

797

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
55. (continued)	• Identify the reactants and products associated with photosynthesis and cellular respiration and the purpose of these two processes. • Describe the carbon, nitrogen, and water cycles—including transpiration and respiration. II-4 Identify how factors affect rates of physical and chemical changes. • Demonstrate knowledge that some factors and substances can affect the rate at which physical and chemical changes occur in living and non-living systems—such as the digestive process. Note: Factors and substances include such things as temperature, surface area, and catalysts—including enzymes. III-3 Differentiate structures, functions, and characteristics of animals. • Distinguish characteristics of vertebrates and invertebrates in terms of a broad but basic range of physical and reproductive traits.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
55. (continued)	• Explain how animals are adapted to their environment—such as protective coloration, mimicry, claws, beaks, etc. V-1 Distinguish relationships among cell structures, functions, and organization in living organisms. • Define and identify representations of diffusion and osmotic systems and what substances are transported by these processes—may include graphic representations. • Recognize differences between active and passive transport of substances and the energy requirements associated with these transport systems. • Classify organisms as prokaryotic or eukaryotic; identify and define similarities and differences between prokaryotic and eukaryotic cells. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
55. (continued)	- Identify and define biotic and abiotic components of different environments. VII-1 Relate the Law of Conservation of Energy to energy transformations. - Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. - Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. - Apply the concept of conservation and transformation of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids. VII-2 Relate waves to the transfer of energy. - Relate wavelength to energy. - Describe how waves travel through different kinds of media.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
55. (continued)	• Describe how waves—earthquake waves, sound waves, water waves, and electromagnetic waves—can be destructive/beneficial due to the transfer of energy. VIII-1 Relate Newton's three laws of motion to real world applications. VIII-2 Relate force to pressure in fluids. • Relate force to pressure in fluids. (Note: Formulas will be provided, where needed, to calculate fluid force in closed systems.) • Apply the concept of fluid pressure to biological systems—such as in strokes, aneurysms, the bends, blood pressure, lung function, equalization of pressure on the eardrum, and turgor pressure.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
56. Relate the use of modern physical techniques, materials, and analytical methods to career and real-world applications.		X	
Science, Technology, and Society			
57. Discuss the mutual influences of science, technology, and society.	III-2 Differentiate structures, functions, and characteristics of plants. • Demonstrate knowledge of which characteristics/traits would be best suited for plants growing in different environments and/or exposed to different pests. VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
58. Identify trade-offs that individuals and society must consider when making decisions concerning the use or conservation of resources.	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems. VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another. • Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations.	X	

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
58. continued)	• Apply the concept of conservation and transformations of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
59. Discuss factors that serve as potential constraints on technological design and use. - Ethics - Ecology - Manufacturing process - Operation - Maintenance - Replacement - Disposal - Liability	VI-1 Demonstrate an understanding of factors that affect the dynamic equilibrium of populations and ecosystems. • Identify and define biotic and abiotic components of different environments. • Identify human activities that affect the dynamic equilibrium of populations and ecosystems.	X	
	VII-1 Relate the Law of Conservation of Energy to energy transformations. • Describe how energy—mechanical, electrical, chemical, light, sound, and heat—can be transformed from one form to another.		

Alabama Course of Study: Science	*Alabama High School Graduation Exam*	Stanford 9	Local
59. (continued)	• Show understanding that energy transformations result in no net gain or loss of energy, but that in energy conversions less energy is available due to heat loss during the transformations. • Apply the concept of conservation and transformations of energy within and between organisms and the environment—such as food chains, food webs, and energy pyramids.		
60. Serve the community through a science-related project. Examples: recycling at school, monitoring air and water quality, evaluating waste-management issues			